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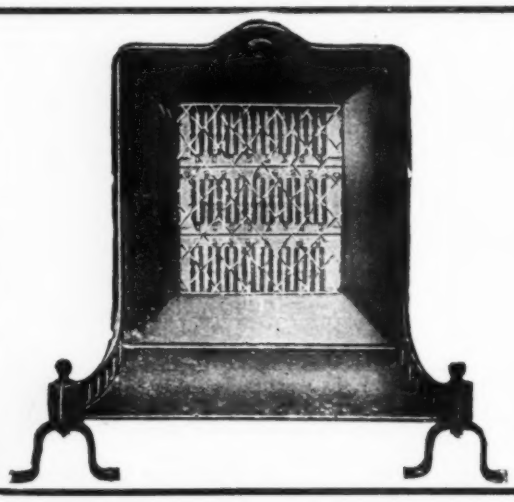

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The

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The Electric Propulsion of Ships.

THE question of using electricity as the motive power for ships continues to be of general interest both to engineers and to shipbuilders, as witness the number of papers which have recently been presented to the various technical institutions on this subject. These papers, to which attention has been drawn from time to time in the ELECTRICAL REVIEW, have frequently dealt with the question from the marine engineer's or the ship-builder's point of view, but it has not always happened that the question has been studied from the point of view of the electrical engineer, who after all is best qualified to say what arrangement of electrical machinery and what form of control gear is best suited to the particular service of driving a ship's propeller. It has been asserted that one reason why electrical machinery was found unsuitable for driving the auxiliaries on board ship, either in the engine room or on deck, was that the electrical engineer had not studied the peculiar requirements demanded of such machinery, and it was only when the problem was fully understood that satisfactory results were obtained. Particular interest, therefore, attaches to the paper entitled "Electricity as the Motive Power for Ships," which was read by Mr. L. Rothera before the Institute of Marine Engineers on February 26th, because here we have an exposition of the subject by an electrical engineer who from his knowledge of the capabilities and the limitations of the electric drive as applied in other directions is well qualified to discuss the question of its application to the propulsion of ships.

Mr. Rothera prefaces his remarks by observing that when the use of electricity is suggested in any new sphere, there is always a good deal of hesitation expressed as to the reliability, &c., of the new form of drive. Thus, in the early days of the application of the electric motor to steel works, it was often asserted

that the electric motor was unsuitable for driving rolling mills owing to the difficult loading conditions and the presence of metallic dust in the atmosphere, and yet to-day electric motors have been in constant operation in steel works for over 15 years, with an upkeep cost of only a few shillings, and there appears to be no reason why they should not continue to operate for many more years equally satisfactorily. He might also have mentioned that opposition has always been forthcoming to the introduction of any new system for the propulsion of ships either on the score of reliability or capital cost, although such opposition has generally proved to be ill-founded. Even the introduction of the steam engine was opposed by those who considered that sails alone represented the satisfactory and reliable method of propelling a ship! Admitting then that the electric drive does possess many substantial advantages over the alternative of either the steam engine or the internal combustion engine driving the propeller direct or through gearing, the problem arises: how best may these advantages be obtained? It is suggested by the author of this paper that the one and only secret of the satisfactory operation of the electrical plant—apart from cleanliness—is that the designer shall know the conditions before installing the machinery; and once such conditions are known, there is no difficulty in putting forward a satisfactory machine. He comes to the conclusion that for small powers the Diesel-electric drive appears to be most suitable, in which case direct current would be employed, while for large powers the steam turbo-electric drive is preferred, the turbines running at high speed directly coupled to alternating-current generators. The limit of power for the Diesel-electric drive is, however, rather difficult to fix owing to the lack of finality in the design of the Diesel engine, but in any case a number of small high-speed Diesel units can be employed and their power applied to a single motor on the propeller shaft up to a maximum of about 5,000 h.p. Above this the turbo-electric drive is indicated as preferable.

The paper then gives a summary of the results obtained from a comparison between the direct Diesel drive and the Diesel-electric drive on the one hand, and the geared turbine and the turbo-electric drive on the other. Space will not permit of our giving the complete results of these comparisons here, but it may be noted that in almost every case the advantage as regards space occupied, weight, and capital cost, is with the electric drive. Thus, as regards saving of space, it is estimated that with the Diesel-electric drive this may be as much as 25 per cent. as compared with the direct Diesel drive, while a saving of weight was also shown, this however depending on the type of Diesel engine used. With regard to the important question of cost, Mr. Rothera states that a most careful comparison was made in a particular instance of a twin-screw and a single-screw boat, putting the two forms of drive on the same basis throughout, and the result showed in both cases a saving of cost on the Diesel-electric as compared with the alternative system. Similarly, in the case of larger vessels, there is a saving both in space and in weight with the turbo-electric drive as compared with the geared turbine drive, but the cost of the former is greater than that of the latter, although this may be balanced by a number of advantages which are obtained in service, such as greater economy under all conditions of load, and lower upkeep charges. It is to be regretted that more detailed information has not been given in the paper to indicate the methods whereby the results of these comparisons have been arrived at, but sufficient confirmation is given of their accuracy by comparison with the results obtained by other independent investigators both in this country and in America. It is apparent, therefore, that, once the bias against the electric drive can be overcome, it will prove of great value on board ship as it has done elsewhere, particularly in conjunction with the Diesel engine for the propulsion of cargo vessels of moderate tonnage, such as form the bulk of the mercantile marine of to-day.

Bankruptcy and its Prevention.

In our recent leading article on this subject, we considered two things: (1) the necessity for electrical firms unitedly to establish an inquiry bureau which would collect information; (2) the setting up of an organisation which would have as one of its main objects the assistance of businesses which might or should in the best interests of the industry be helped to weather a temporary storm. The two-fold proposition has attracted a good deal of attention. Reliable evidence to that effect has reached us, and some of it appeared in our last issue, but we know that every piece of written evidence of interest that reaches us is a sure indication that much other thought is being devoted to the subject without finding expression save in conversation. We have been asked whether our leading article was meant to be just a review of the subject or whether we were prepared to back a sound proposition with our full support. It must be recognised that many movements in the electrical industry have had their origin in articles which have appeared in the Electrical Review. The correspondence and discussion that have arisen have ultimately led to personal conference of men of practical knowledge of the subject, men who were zealous in a cause which appealed to them as deserving of the expenditure of their time, energy, and brain power. We can provide the platform for the discussion, or the field for the contest, or a jumping-off place for such efforts. Our full assistance is a foregone conclusion if a movement is desirable, receives sufficient support, and promises to develop along sane lines.

In the present case we invite further discussion of the subject. The first of our propositions has been described as a tough one, but it may be that it does not lie beyond the ingenuity of leading commercial men to tackle a difficult problem. The second half of our proposal may also be difficult, but it has aroused favourable comment, and has brought us evidence that something of the kind has been thought about already, and preliminary efforts have been made to give practical shape to a scheme. In the absence of the details, however, we can say nothing regarding it at the moment, except to record that it has received a certain amount of consideration—more or less casual—" in the City."

After all, it is for the electrical industry and trade to decide whether such a trade organisation can or cannot help in the directions indicated in our article. We hope, therefore, that anybody who has any useful ideas to express will send them along without delay.

Undesirable Investments.

When there are in course of preparation a number of sound and perfectly legitimate electrical enterprises for which public subscriptions may sooner or later be required, it is not altogether pleasing to have to issue a warning to the potential investor regarding other and very undesirable propositions which are in circulation. The uninitiated might form the impression that all electrical issues were tarred with the same brush, and if there is anything that the electricity supply industry desires to avoid it is a return to unpopularity among the investing public. We ourselves are far from desiring to create an atmosphere of suspicion which would be unfavourable to the plentiful investment of money in all branches of the electrical industry. Probably the real reason why certain people have chosen this moment for introducing their speculative enterprises to an unsuspecting public through the post—without seeking the publicity of the Press—is to be found in the very satisfactory results that have lately been obtained by so many electric supply companies. Speaking generally, readers of the Electrical Review are capable of forming a sound judgment for themselves when a definite electrical proposal lies before them, but sometimes the pitfalls are not obvious to the man who is in a hurry, however well-informed he be in regard to the ways of the world, or to the merits of some departments of the industry. Old and experi-

enced hands may well wonder how anybody can be induced to part with money for some of the small electricity undertakings which have been made the subject of prospectuses lately issued, for none of the information upon which one generally bases estimates of revenue, profits, and prospects is vouchsafed in these documents, while, on the other hand, there are some things stated which, even more than the omissions, make it safer to leave such propositions severely alone. We urge our readers to examine most closely privately circulated prospectuses of the kind indicated, and to do their best to save their friends from being bitten.

The Lordly Shannon.

Last week we briefly referred to the newspaper reports of the latest proposal to harness the Shannon Falls, in the neighbourhood of Killaloe and Castle Connell. We say the latest, because the Shannon, perhaps more often than any other river in Great Britain and Ireland, has been the objective of power seekers. It is the largest river in these islands, and its flow records are continuous for thirty years, probably a unique record in the history of our rivers. During the war a serious investigation of its capabilities was undertaken by Mr. Theodore Stevens, on behalf of an important syndicate which required about 50,000 h.p. for the manufacture of ferro-chrome in competition with the cheap water-power factories of Norway, and the Irish Sub-Committee of the Water-Power Resources Committee, appointed by the British Board of Trade, made a further investigation of the river between 1918 and 1920, being assisted by several reports which Mr. Stevens prepared specially for its use. We hope to deal at length, in a future issue, with the whole problem of the Shannon, but for the present it is not possible to do more than express, with the courtesy and diffidence due to the internal policy of another country, our doubts as to the wisdom of the course the Irish Free State Government seems to be prepared to follow.

An agreement, subject presumably to ratification by the Parliament of the Free State, has been made between the Executive Council and Messrs. Siemens-Schuckertwerke, which gives the latter a conditional monopoly of the Shannon Falls for power purposes on the lines detailed on p. 414 of our last issue.

We have nothing to say about the policy of the Free State in offering facilities to foreigners for providing one of the greatest needs of modern life, if there is no better alternative, but it will not be overstepping the bounds of international courtesy if we suggest that the people of the Irish Free State shall take a good look into the mouth of this gift-horse before they decide to jump down its throat; for it is beyond the comprehension of anyone who has made himself familiar with the hydrometry of the Shannon how Messrs. Siemens-Schuckert can have the effrontery to state that *electrical power in sufficient quantity can be procured from the Shannon to meet the present and prospective needs of the whole of the Free State.*

They must know, and the advisers of the Free State Government must know, that the Board of Trade Sub-Committee estimated the continuous horse-power of all the rivers in the entire island at 500,000; and that the more recent Commission of Inquiry into the Resources of Ireland, working very carefully upon the published figures of the Shannon discharge, decided that an average annual output of 52,000 h.p. might be obtained from 75,000 effective h.p. of installed plant, *if* the storage of 10,000 million cu. ft. premised by the Board of Trade Committee could be obtained, which the Commission took leave to doubt.

If the bona-fides of Messrs. Siemens-Schuckert is to be gauged by their leading claim, it seems to us that our warning is justified.

If a similar proposition were made to the British Government, it might occur to us to suggest that a foreign power monopoly might be transmuted in course of time to power of a less desirable nature.

Advantages of Electric Melting of Brass.

Some of the most important metallurgical research within recent years has been carried out by the U.S. Bureau of Mines, and a list of the "theoretical" advantages of electric brass melting was recently published by this official body. Why they are termed theoretical advantages is not quite clear, because there is frequently a wide divergence between theoretical and practical advantages, and all that is claimed for the electric furnace by the U.S. Bureau has been amply proved by metallurgists in America and England who have had practical experience with coke, oil, and electric methods of melting brass. Engineering theory is the stepping stone to practice, but it may take years of experimental work before the discoveries of the laboratories can be adopted in the workshop. The "theoretical" advantages claimed for electric brass melting are as follows:—

(1) Melting may take place in a neutral or reducing atmosphere, thus minimising loss of metal by oxidation and improving the quality of the product through freedom from oxides; (2) metal of crucible quality may be obtained without the use of crucibles; (3) melting may take place in a tightly closed chamber, or at least in one free from the constant passage of the products of combustion of fuel, and thus losses of volatile metals, such as zinc and lead, may be reduced (contamination by sulphur from fuel is avoided); (4) in some types of electric furnace the temperature may be more readily controlled than in fuel-fired furnaces; (5) in some types of furnaces the molten metal is thoroughly stirred, thus giving a uniform product, even with large heats; (6) there is no handling or storage of fuel such as coke, coal, or oil, and no ashes have to be removed (the cost of power can be accurately predicted over longer periods than the cost of fuel); (7) working conditions about the furnaces are less dangerous to the health and safety of workmen, provided suitable types of furnaces are chosen; (8) the above advantages may be obtained in furnaces of larger capacity than can be used satisfactorily in the fuel-fired crucible types, with resulting greater uniformity of product, lower labour cost, and increased production.

The first advantage is common to the electric melting of all metals, ferrous and non-ferrous. With regard to the quality of the metal, it is no exaggeration to say that electrically-melted brass is purer and contains a smaller percentage of objectionable impurities than coke-melted brass. A uniform product is always ensured, especially in the rocking type of furnace, although the rocking is done primarily to keep the furnace lining cool. Zinc and lead losses are very great in crucible melting, and render it very difficult to obtain a mixture of a specified composition. As for the sulphur contamination from fuel, this applies equally to the cupola or open-hearth melting of iron, and is a serious problem with so much inferior war-time metal on the market. It is not altogether, however, a fuel question, and the steel metallurgist is equally perplexed about it. It is interesting to note that Mr. J. H. Whiteley, F.I.C., in a paper delivered before the West of Scotland Iron and Steel Institute on "The Sulphur Content of the Acid Charge," said that "in considering the circumstances likely to cause an increase of sulphur during the melting period, it should be noted that under the oxidising conditions which prevailed in the furnace, the flame could never come into more than momentary contact with metallic iron." Mr. Whiteley appears, however, to have dealt solely or chiefly with gas-fired or open-hearth furnaces. Brass melting has peculiar problems of its own, but there are remarkable similarities in the melting of all metals, and it would be instructive to have an exhaustive report by a responsible research authority showing, in detail, how the electric melting of brass differs from that of steel and iron.

The Enham Village Centre.

An Enterprising Undertaking.

The Enham Village Centre for the curative treatment, training, and eventual settlement of disabled ex-Service men, whose disabilities prevent them from earning a livelihood in open competition with their able-bodied comrades, is unique inasmuch as it is the only venture of its kind in this country that is maintained on a purely voluntary aid basis. The deserved success with which the initiative of the Village Centres for Curative Treatment and Training Council (Inc.), under the administration of Major Alan Garthwaite, D.S.O., M.C., has met is gratifying.

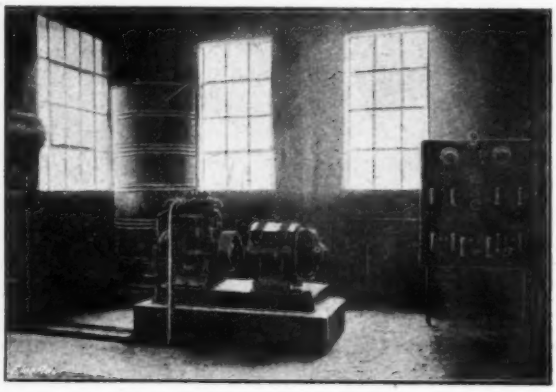


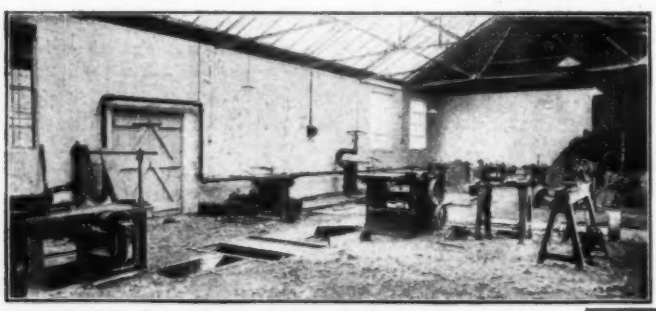
Fig. 1.—Electric Lighting Plant.

The birth of the venture in 1918 was assisted by the late Sir E. Cassel, who advanced a sum of £30,000. By the end of the first year, with the help of public subscription, a £10,000 fund had been established in the Westminster Bank; a sum of £20,000 was also secured on mortgage, which enabled Sir Ernest to be repaid. Public appeals were then issued and shortly afterwards it was found possible not only to repay the bank, but also to enter into possession of an estate of 1,027 acres, free from all encumbrances, at Enham, near Andover, in Hants. It thus became practicable for the Centre to undertake the permanent portion of the task that it had set itself—namely, (*a*) the provision of productive workshops for the permanent employment of as many disabled men as possible, and (*b*) the housing and eventual settlement of the men.

Formerly, of course, the training of the patients proceeded under difficulties, with temporary workshop accommodation in the form of converted ex-Army huts, the only plant being a semi-portable, 6-b.h.p., single-cylinder steam engine, driving a circular saw and one band saw, which installation fig. 5 shows to be still in constant useful employment.

Fig. 4.—Cabinet Making Shop.

The Council, realising that the trainees, handicapped as they were by virtue of their war disability, would be unable wholly to support themselves on an industrial basis, decided to erect a fully-equipped modern workshop with the help of the Development Commissioners, who agreed to advance half the necessary sum, and create an endowment fund. It was thought that £100,000 invested at 5 per cent. would enable the Council to employ and settle permanently 250 men at a reasonable wage, provided that cottage accommodation was available. Steps were accordingly taken to provide houses for those men who (*a*) having completed their training would, because of their war disability, find it difficult to compete in the ordinary labour market, but who could be made productive under proper conditions,



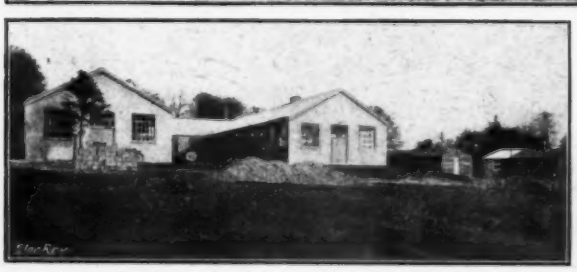


Fig. 2.—Wood-working Machine Shop (top).
Fig. 3.—A portion of the New Factory (bottom)

Fig. 5.—Log Saw Mill (top).
Fig. 6.—The Manor House (bottom).

and (*b*) were triers so far as their strength permitted and wished to remain at Enham.

An exterior view of part of the new factory, which is capable of affording employment for 150 men, is reproduced in fig. 3, to the right of which can also be seen some of the ex-army huts used during the temporary phase of the scheme. Electric light is used throughout, each shop being furnished with three rows of gas-filled lamps, as illustrated in fig. 4; those in the centre are of 150 W each, and those in the side rows of 100 W each. The generating plant is shown in fig. 1; it consists of an Aster 16-b.h.p., 1,000-r.p.m., petrol-paraffin engine coupled direct to a 40-ampere, 220-volt generator, by Messrs. Newton, of Taunton.

The shops are heated by hot water, and the wood-working machinery, which is shown in course of erection in fig. 2, is belt-driven from shafting housed entirely in pits under the shop flooring, the power being furnished by a 42-b.h.p. Fielding & Platt semi-Diesel horizontal oil engine.

Two types of patient are accepted: (1) those sent by the Ministry of Pensions from the hospitals who require both curative treatment and industrial training, and (2) those sent by the Ministry of Labour who need training only, no man being eligible for the second class unless by virtue of his war disability he is prevented from following his pre-war occupation, or only doing so with a large diminution of his wage-earning capacity. The men are taught to make all sorts of hand-made furniture and cabinet work, garden furniture, estate and general carpentry, in addition to French polishing, upholstery, basket work, &c. General assistance has been given by the Rural Industries Intelligence Bureau and the Development Commissioners from time to time.

Fig. 6 is a view of the old manor house on the estate, wherein the single men are housed under the care of a resident medical staff; married men are provided with cottages of which a number has been, and more are to be, built on the estate, while permanent settlement has been found locally for patients who have undertaken small holdings, poultry rearing, motor garage, village blacksmith's, and such like trades. Of the quality of workmanship and materials employed we have personal knowledge, and as obviously the more products sold, the greater the number of men it will be possible to employ, it is to be hoped that the motto of "Help us to Help Ourselves" will not be unheeded.

In conclusion, it may be remarked that the scheme is an entirely philanthropic one, and is registered under the War Charities Act. The whole of the electrical and other engineering work in connection with the new factory was carried out by Messrs. Baxter and Caunter, Ltd., to the design of Capt. H. P. S. Wise (industries superintendent), to whom we are indebted for the courteous reception accorded us on the occasion of our visit to Enham.

Some Methods for the Fine Adjustment of Reaction.

By ALAN. L. M. DOUGLAS, M.I.R.E.

Now that so much attention is being paid to the question how to introduce "safe" reaction into a valve receiving circuit, it is still more important to be able to adjust this satisfactorily within very narrow limits. Generally, it is found that in a receiver without high-frequency amplification, it is far easier to control reaction effects than when one or more h.f. stages are used. This is because the reaction is effected into the aerial circuit, and it is therefore bound to influence succeeding valve stages because it is directly applied to the grid of the initial valve. This does not always follow when intervalve reaction is adopted, because it is often difficult to obtain proper phase relation between the high-frequency coil, to which the reaction is applied, and the low-frequency coil which is actually coupled thereto. At the best, and unless some damping arrangement is introduced into the high-frequency circuit, reaction is either "on" or "off," so to speak; in other words, it is not easy delicately to control the effect, and in consequence some other means must be adopted.

Now, I have often found that much more controllable effects can be obtained by the use of reaction directly upon the aerial circuit. This sounds piratical, but if the adjustment is properly carried out, the risk of re-radiation is practically nil, and a looser coupling is used to produce stronger reaction effects. If reaction is applied to the anode circuit of the high-frequency valve, a fairly distinct coupling is necessary to neutralise the h.f. resistance of that circuit, but if the reaction takes place on the first grid, a very loose coupling will produce the same effect. It is preferable to work with a very loose coupling if possible, and we shall examine how best to carry out this adjustment. Fig. 1 shows an ordinary reaction circuit with a damping plate connected

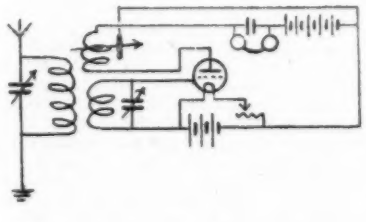


Fig. 1.

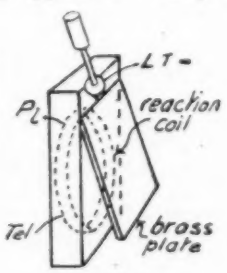


Fig. 2.

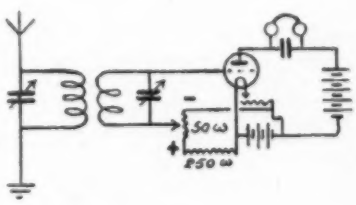


Fig. 3.

thereto. This is a mechanical device, and consists of a small disk of metal equivalent in area to that of the reaction coil and pivoted thereto so that it can be swung over the coil (fig. 2). By means of this arrangement we can loosen the magnetic coupling to the required degree, and then obtain delicate adjustment by means of the disk. The metal of which this is made should be brass or copper, at any rate a non-magnetic substance. This is a wasteful method of control, so that the method shown in fig. 3 is more useful generally. Here there is no reaction coil, but a potentiometer is used to control self-oscillation. It is sometimes found that this state cannot be induced in the receiver, but it is always possible if the anode voltage is high enough. For satisfactory and delicate reaction control it is of little use employing

the ordinary commercial type of potentiometer. The voltage change occasioned by one complete turn of wire, small though it be, is too great for really critical operation, and so the arrangement shown in fig. 3 should be adopted. Here we have a fixed resistance of about 250 ohms connected in the + battery lead, with an adjustable rheostat of about 50 ohms on the negative side. As we very rarely require to approach the + side of the potential range, it is sufficient to have a vernier adjustment on the − side to accurately control the grid

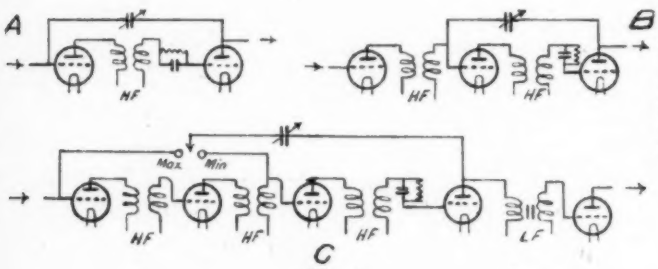


Fig. 4.

voltage. This 50-ohm rheostat can be quite large, so that each turn of wire represents a very small potential change, and so delicate regulation can be carried out.

A combination of this method and the previous one will sometimes be found extremely useful, and the potentiometer can be used to control reaction from the magnetic coil instead of the metal damping plate, if desired. Yet another method suggests itself, and that is the use of electrostatic or capacity reaction. The theory of this is rather involved, but it must be noted that it can only be carried out between even numbers of valves. That is, between two valves it could be arranged as in fig. 4A, between three valves, as in fig. 4B, and between four valves, as in fig. 4C. This is generally a very controllable method of reaction, but sometimes on the shorter wavelengths it is difficult to keep the capacity of the condenser low enough. For this reason the use of a small tubular condenser is suggested, as in fig. 6. This may have a maximum value of about .00001, and be dimensioned as in the figure. Glass test-tubes, obtainable from any dealer in chemical apparatus, function admirably as the tubes, and the glass is thin enough to permit of a gradual capacity change. One advantage of this method is that it is very useful for the reception of long waves, the capacity not exceeding .0003 μF even for wavelengths of the order of 30,000 metres. Another method of obtaining reaction, or rather of accurately controlling it in

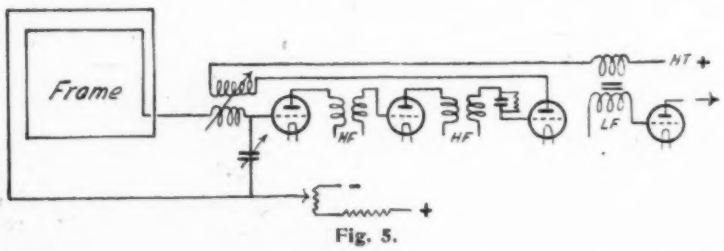


Fig. 5.

high-frequency amplifiers, is to use a vernier filament rheostat for the detector valve. This is often a very useful control device, and was largely used during the war for such a purpose, where often the reaction coil coupling was fixed. It should be remembered when switching high-frequency valves out of circuit that this entirely upsets the adjustment of the reaction circuit, and often accounts for the trouble experienced in getting the reaction effects back again. If several h.f. valves are used in the circuit, it will sometimes be found necessary to reverse the direction of the reaction coil when the number of h.f. stages in use is altered, and for this reason it is advantageous to employ one of the other methods mentioned for producing reaction effects. Receivers utilising frame aerials can generally be made to oscillate very readily over the whole range, and in this case a potentiometer should always be employed, chiefly to prevent magnetic interaction between the reaction coil and the frame. Where, however, it is desired to use the magnetic method of coupling, it should be arranged as shown in fig. 5. The frame coil should, of course, be as small as possible, and should be included in the main oscillatory circuit, *i.e.*, it should be adjustable by means of the tuning condenser as well as the rest of the frame. The foregoing hints may be of value to those troubled with uncontrollable reaction, but I would point out that changes in the h.p. and l.p. voltages vitally affect the reaction adjustment, and therefore the values should not be altered.

Rural Electricity Supply in Buckinghamshire.

A MEETING was convened at Aylesbury, the week before last, of the mayors, town and rural district councillors, and clerks to the various authorities in Bucks. to consider the above-named subject. This meeting, which had a large and enthusiastic attendance, was held under the presidency of the Mayor of Aylesbury, and the speakers were Mr. R. Borlase Matthews and the Town Clerk of Aylesbury. The former dealt with the technical features and advantages of an electricity supply for villages, farms, and rural industries generally, while the Town Clerk explained the various Acts and Regulations under which it was possible to obtain the necessary powers for distribution to the whole county, from Aylesbury. The credit for the inception of this meeting was undoubtedly due to the enterprising chairman of the Aylesbury Electricity Committee and the energetic electrical engineer to the Council, Mr. W. A. Turnbull.

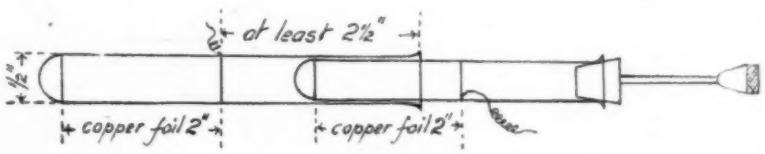


Fig. 6.

The meeting was of great importance on account of its significance as to the movement that is slowly, but surely, starting to ensure a supply of electricity to every part of England. An animated discussion followed the speeches, which indicated an intelligent interest in the subject, though naturally, as is always the custom of town and rural district councillors, reference was made to the "infancy" of electricity. Mr. Matthews upset some of these views very effectively by pointing out in a practical manner the great economies that could be effected on farms by the use of electricity; how 20 per cent. more eggs could be obtained in winter time; how cattle could be fed in one-third less time; how the saving in milk spillage in the cow barns more than saved the cost of the light; how the cost of electric ploughing was only 2s. 8d. per acre for electricity (or eight to ten shillings per acre, with the addition of the cost of labour, interest and depreciation—as compared with 25s. for horse ploughing); how very much cheaper was electric power, even at tenpence per unit, than the cost of the equivalent power when obtained from horses or men; how for the value of one ordinary wooden match, the residents of Aylesbury could obtain half-an-hour's electric light from a ten-watt lamp (this made a great impression as to the economy of the local supply); how there were over 52,000 electrically equipped farms in Sweden, where the rate for electricity was higher than in most English towns, and where electricity could be produced by coal (and brought from England at that) as cheaply as by water power, for the conditions of farming loads (not, of course, for 24-hour metallurgical loads).

An interesting fact was elicited from the Town Clerk's speech, in that the various electricity supply authorities had been circularised by the Government to the effect that grants of 60 per cent. would be made towards all work carried out this year, in order to relieve unemployment—evidently a

golden opportunity, from an electrical point of view, that is not to be missed. Judging from the various comments upon these speeches, it will not be long before Bucks. is an electrified county.

At the conclusion of the meeting an inspection was made of an exhibition of electric cookers and other appliances—including an ingenious and cheap electric water heater of Mr. Turnbull's design. Subsequently a visit was paid to the electricity works, which are very large considering the size of the town of Aylesbury, viz., over 3,000 kW for 12,000 population.

Legal.

Cecil Hodges & Co., Ltd., v. Brunker.

In the King's Bench Division of the Irish Free State High Court recently, Mr. Justice Dodd received and made a rule of Court a consent to settlement in an action by Messrs. Cecil Hodges & Co., Ltd., Dalston Lane, London, against Mr. T. F. Brunker, Dublin, and a counter-claim.

The plaintiff company claimed £197 12s. 3d., the price of goods sold and delivered to defendant, who counter-claimed for £500 damages. It appeared that defendant purchased from the plaintiffs for £150 a gas engine, dynamo and fittings, being part of the goods for which he admitted liability, for the purpose of fulfilling a contract for the supply of an electric lighting plant to a customer. Defendant alleged that the goods supplied were not reasonably fit and proper for the purpose, that he was unable to complete his contract, and that, as a consequence, he incurred liability to the customer. A sum of £180 was lodged in Court by defendant, but he denied having received the residue of the goods.

Counsel for defendant said it had been agreed by the terms of settlement that the plaintiff company's claim be dismissed, with costs, that the company pay to defendant £250 for damages in full settlement of the counter-claim, that the money lodged in Court by defendant be paid to him, together with £70, being the company's sum on the consent, and that the company pay all defendant's costs.

British Thomson-Houston Co., Ltd.; Patent Litigation.

An application was made to Mr. Justice Eve, in the Chancery Division on March 14th, for the release from prison of Emanuel Shulman, who was committed for contempt of court in not obeying an order made at the instance of the British Thomson-Houston Company, Ltd., restraining him from infringing its patent for electric lamps. Mr. Buckmaster, for the applicant, read an affidavit by him apologising for the manner in which he had treated the injunction, and saying he had no knowledge of his daughter's supplying the lamps complained of. He had no intention of disregarding the orders of the Court, and neither his wife nor daughter would infringe the injunction granted against him.

His Lordship made the necessary order for prisoner's release.

Mr. Trevor Watson, on behalf of the British Thomson-Houston Company, Ltd., mentioned to Mr. Justice Eve in the Chancery Division on March 14th the action by that company against the Metropolitan Advertising Company, Ltd. He said that Mr. Palmer, who appeared for the defendants, was willing to treat a motion in the action as the trial and to consent to the ordinary order for an injunction, to an inquiry as to damages, delivery up, and solicitor and client costs. His Lordship granted an order accordingly.

British Thomson-Houston Co., Ltd., v. Charlesworth, Peebles & Co.

In the Edinburgh Court of Session, on March 15th, before the Lord President and Lords Skerrington, Cullen, and Sands, the Division advised a reclaiming note for the defenders in the action of interdict at the instance of the pursuers against Charlesworth Peebles & Co., of Glasgow, and for £10,000 as damages for the infringement by the defenders of a patent dated 1909, by the importation and sale of incandescent lamps with tungsten filaments made in the manner described in the patent. The defenders challenged the validity of the patent on the grounds of anticipation, want of subject matter, and insufficiency of description, and they denied infringement.

In the Outer House Lord Blackburn sustained the validity of the patent, granted interdict and expenses, and *quoad ultra* continued the cause for proof on the question of damages. The defenders reclaimed.

The Division, by a majority, adhered to the interlocutor of the Lord Ordinary and continued the cause for further procedure. The pursuers were awarded expenses.

The Lord President, Lord Cullen, and Lord Sands, were of opinion that the patent was not open to challenge.

Lord Skerrington, who dissented from the judgment of the Court, thought that the patent should be declared to be invalid in that the specification did not particularly describe and ascertain the nature of the invention.

An appeal is to be made by the defenders to the House of Lords.

British Thomson-Houston Co., Ltd., v. British Insulated and Helsby Cables, Ltd.

On March 17th, before the Master of the Rolls, and Lords Justices Atkin and Sargant, the appeal of the defendants from the decision of Mr. Justice Russell maintaining the validity of the plaintiffs' 1909 patent for drawn tungsten wire was mentioned. Sir Arthur Colefax, K.C., for plaintiffs, said that an application had been made for the postponement of the trial of a large number of cases which were dependent upon the decision given in the appeal, and suggested that the appeal should be heard on March 31st. Sir Duncan Kerly, K.C., for appellants, accepted this date, but gave notice that he would apply in due course for the postponement of the large number of cases referred to. The Master of the Rolls confirmed the date subject to any part-heard case. In response to an application by Sir Duncan Kerly, their Lordships consented to hear the appeal of defendants from the decision of Mr. Justice Tomlin, refusing postponement of the cases, on Wednesday last.

Electrical Sales in New Zealand.

Some useful hints regarding the sale of electrical goods in New Zealand have been sent to the Canadian Government by its assistant trade commissioner at Auckland, Mr. C. M. Croft. It is not surprising to learn, in view of the great developments in hydro-electric work which have been going on in the Dominion for many years, that competition at present in this line of business is very keen, and that manufacturers of all classes of such goods have their products on the market. Mr. Croft recommends his countrymen to pay more attention to the quality and finish of their goods. He suggests that careful consideration should be given to the packing and to the use of cartons—points which United States exporters find very useful in aiding their sales. One of the leading wholesalers in Auckland, he says, recently landed a consignment of electrical goods from Canada and found that every article was more or less damaged. It cost the importer approximately 25 per cent. of the invoice price for repairs. Mr. Croft gives the following summary of the position regarding the various classes of electrical goods in demand. The use of electric ranges for household use is increasing. The electric power boards throughout New Zealand supply power for heating at a low rate, and the use of ranges will probably increase considerably. The use of electrical systems for heating water is increasing at present. In many of the rural districts the farmers are installing electrical equipment to provide hot water in connection with dairying operations. One of the leading importers of electrical goods stated that he is now retailing a complete system, comprising a 500-watt unit and a 15-gallon tank, for £12. During the winter months electric radiators are used very extensively, and when the developments under construction are completed it is very probable that the demand for them will largely increase. The radiant-glow type of heater is in keen demand. At the present time the English manufacturers are doing a large business in this type, and the finish of their heaters is said to be better than that of the Canadian. Their price is considerably lower, the current retail price being about £3 10s. There is a small demand for the resistor type of radiator, but not sufficient to warrant special attention. The radiator of the type that employs lamps as heating units is practically out of use now; a number are to be seen in the various offices, but these are of old stock, and the dealers have ceased to order them for new sales. Electric grillers are in steady demand, and their use is increasing. Irons are used considerably, and the demand is steadily increasing. Some Canadian firms are shipping to New Zealand, but their manufactures are reported as being too light; the metal parts for use in New Zealand should be heavy. English exporters are securing a large portion of the business, and the United States firms are also competing. Irons made in England sell at 25s., whereas those from Canada are on the market at 32s. 6d., and the quality of the lower-priced English article is practically the same as the Canadian. There is a very small demand for electric toasters. There is a possibility of developing this trade, but this depends on educating the people in the use and advantages of this commodity. Hot plates are sold quite extensively. There is a very small sale for such apparatus as soldering bolts, curling tong heaters, glue pots, &c. There is practically no demand for electric washing machines. Some have been brought into the country, but they have not proved saleable, chiefly on account of the very high prices. Machines must be landed in New Zealand to retail at less than £30. So far electric wringers have not been sold to any extent in New Zealand, but it is known that some firms in the United States are endeavouring to place these articles on the market. It is the opinion of the trade that it will not be long before a demand develops for this type of equipment. There have been very few electric ironing machines sold in New Zealand; the price is prohibitive. It is probable that sales could be made if the price were low enough. There is a fair market for electric fans, but these are not used to the same extent as in Canada.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Wiring in a Corrosive Atmosphere.

Your correspondent "H.A.D." raises points of considerable interest to the industry, opinions still being at great variance as to the best means of tackling the problems raised.

After many years' experience of installation work one is, however, forced to the conclusion that there are establishments wherein the conditions preclude the idea of real permanency with the materials at present at our disposal.

It would therefore appear to be the best practice, where such conditions are foreseen, to install a system which permits of easy and economical periodical replacement, selecting materials with the longest economical life, and locating them in such positions and manner that as far as possible the cables, &c., are easily get-at-able and not likely to cause trouble in case of failure, although, of course, by reasonable maintenance this stage should not be allowed to be reached.

Switch and fuse gear can generally be located either outside the buildings altogether, or in positions where conditions are better. Ceiling roses can frequently be avoided, the cables being looped into the lampholders. Cab-tire-sheathed v.i.r. cable undoubtedly has the longest useful life, and at present appears to be the only practicable method of meeting the conditions raised.

Substantial teak cleats are advised by some fire offices, so the fire risk cannot be great, but as single-core conductors are frequently more convenient, and safer to use, porcelain cleats can be used if preferred. Porcelain tubes should, of course, be used where additional protection is required for passing through walls, &c.

End troubles are lessened if single conductors are used instead of stranded ones, but there should be no trouble in sealing the cable into the moulded-composition or hard-rubber lampholders used for this class of work. Well glass fittings are best omitted.

This open wiring has disadvantages as pointed out, and its location must be carefully considered, but it is difficult to see how it is to be avoided. Distemper or paint does not appear to be deleterious to c.t.s. cable, and it will withstand grease well; in fact, it has been immersed in oil for some months before softening.

For boiler-house and similar use, screwed conduit with a fairly high-grade v.i.r. cable appears to give the best service. Tubes should be of ample bore and stepped off the walls, &c., on malleable brackets.

H. W.

Southgate, *March 11th*, 1924.

In connection with the above subject I would like to say that after some ten years' experience with different wiring systems it is my opinion that nothing can beat c.t.s. cable for all-round work, including that in a corrosive atmosphere.

C.t.s. cable offers very many great advantages; amongst others, minimum stocks and no accessories are required, labour is decreased, there is great flexibility, it can be used equally for power, lighting, or as flexible, &c. Now, these advantages have all a concrete monetary value so that in the end this particular system, in my experience, gives a very economical job which at the same time cannot be improved on by any other system of wiring.

Starting from this premise it is my contention that as, in general, the various peculiar atmospheric conditions specified will only occur in quite a small area of any works, it would as a matter of fact be quite worth while continuing in c.t.s. cable there as well, even if it became a little more expensive to erect. On the other hand, however, c.t.s. cable can even there be installed as cheaply or cheaper than any other system, and will last much longer, *provided* the erector has exercised real care and forethought in planning his scheme; that is the secret of real success in the use of c.t.s. cable in such circumstances.

Given that it is kept free from mechanical damage or abnormal movement (such as bending or unbending), and that is one of the details which has to be, and can be manipulated —c.t.s. cable will last for years in damp, hot, salt impregnated atmospheres which nothing else will stand up to. In those other situations where it is feared the rubber may be attacked somewhat and perish, it is quite simple to, in one's own mind, treat them as bare cables and cleat, protect and space them accordingly. It will be found that, still given the freedom from mechanical disturbance, the insulation still holds.

As regards the frequent extensions and alterations also mentioned, I do think this is a little unusual, and should be met by some scheme of plugs and flexibles. As regards fittings, some of the cable companies market special non-corrosive lines.

I have myself spent a good number of years in the tropics, and my experience there was such as to make me advocate (for those countries) cleated v.i.r. cable for low-voltage lighting circuits where appearance was not vital, but price was, and c.t.s. cable in other situations. I should add perhaps that I have no special interest in any particular system, being just an ordinary

Contractor.

March 10th, 1924.

I hesitate to enter into correspondence when letters appear without the identity of the writer being known, and the letter signed "H. A. D." might easily suggest that the writer has been "had," to use the slang expression. However, I venture to express a few opinions in view of the interesting points raised.

It is first of all a mistake to speak of the cost of any particular system of wiring unless service is also taken into consideration. Cost, plus service, should form the basis of all estimates.

The "fire risk" item is almost invariably exaggerated and, with liberal rating of the cables, combined with sound workmanship, the three systems mentioned by "H. A. D." are equally safe, always presuming that the situation is suited to the system.

This brings me to the four conditions given as examples, and from my experience the toughened-rubber, which I prefer to call c.t.s. cable, will stand up to the severe requirements enumerated. Obviously, your correspondent has overlooked the essential sealing of the cable ends at lampholders and switches, which would overcome the objection mentioned. Porcelain cleats can be used with this cable if the round section is employed, and I have experienced no difficulty in running the cable on steelwork.

I cannot mention any system which more readily lends itself to frequent extensions and alterations to point locations than c.t.s. cable, provided the ends of cables are always sealed in severe situations as previously mentioned.

W. Ellerd Styles, M.I.E.E.

Manchester, *March 10th*, 1924.

Your correspondent has certainly painted his picture very black indeed; he has presumably tried all the known systems in everyday use, and found in them all "something missing." I cannot imagine any condition where the contents of these "witches' cauldrons" are brewed for the express purpose of attacking the conduit and wire of the electrical system. One has to imagine that no real good system of ventilation is in use to carry away the corrosive fumes as soon as they are formed, and unless the workmen wear gas helmets or have the inside of their bodies well aired, their lungs must be in a painful state. Tackling the job in the light of my own experience, I should without any hesitation strongly recommend the conduit system, using C.M.A. 2,500-meg. grade wire, and if the word "hot" must be construed as *hot*, a form of ventilated watertight conduit would be necessary, having outlet boxes with packing glands to take a good make "cab-tire flex" above every present and possible point location. Provided sufficient 3- and 4-way draw-in boxes with spare outlets be allowed, the wiring capacity of the conduits allowing for a 50 per cent. extension and spare draw wires left in, I see no difficulty in overcoming "the frequent extension and alteration to point locations" without impairing the original scheme one iota.

The exterior of the conduit would be given, before erection, two coats of anti-corrosive paint, and periodically when the statutory conditions have to be met.

There are many electrical firms of repute that would readily give a long period guarantee if the *engineer* in charge of the job were given a free use of his imaginative powers, and *that extra* £50 was not stinted in the original estimate.

Only a Wireman.

Bideford, *March 9th*, 1924.

[The Imperial Lighting Co. (Implitico, Ltd.), suggests the use of its "Fairyland" system, in which the conductors are insulated with a special preservative, the holders and junction boxes are made of porcelain, and no metal parts are exposed. Neocellon, Ltd., proposes to "Cellonise" the wiring—*i.e.*, to impregnate the covering with a Cellon lacquer.—Eds. Elec. Rev.]

Single-phase Induction Motors and the Starting Problem.

While not wishing to side-track the above question, or to start a discussion on the merits or demerits of centrifugal clutches, we should like to make the following observations *re* Messrs. Broadbent's letter in your issue of March 7th. Our previous letter was under the above heading, while Messrs. Broadbent, in their letter, do not refer to single-phase motors at all. A centrifugal clutch fitted to a polyphase motor is not comparable to one fitted to a single-phase motor as regards operation. In the case of three-phase motors, a centrifugal clutch is an unnecessary luxury in 99 per cent. of installations, owing to the motors' extreme flexibility, large percentage slip, and overload capacities before stopping.

For these reasons the adaptation of a centrifugal clutch to them is a simple matter. Using a star-delta starter almost full-load torque may be obtained at starting and in the

majority of cases, the introduction of a clutch only means a delay in the load being put on to the motor.

The case of a centrifugal clutch applied to a single-phase squirrel-cage motor is entirely different. The starting torque is small and, when the phase-splitting starter is in the starting position, the overload capacity is nil, and the percentage slip before the motor will pull out of step, with most makes, is not more than 10 per cent. It follows that unless the operator switches over from the "start" to "full" position within a few seconds of the motor attaining full speed, the motor is pulled out of step.

What is wanted, therefore, is a clutch giving a short waiting period between the motor attaining full speed and the clutch shoes engaging.

We like the sporting offer of Messrs. Broadbent, and may take an early opportunity to avail ourselves of it. We note in their catalogue that they list two types of clutches, one being "spring-controlled" for single-phase motors. From this it can be inferred that they have experienced some trouble, such as is indicated above. We can assure Messrs. Broadbent there is nothing that would give us more satisfaction than the discovery of a perfect clutch for a single-phase squirrel-cage motor. By a curious coincidence we find, on looking through our order book, that within the last five weeks we have purchased two small clutches from them, and await with interest a report on them under working conditions.

It is also another curious coincidence that another firm of centrifugal clutch pulley makers supplied us with a 50-h.p. clutch pulley, which they failed to make function properly. The firm in question is replacing this with a Broadbent *hand*-operated clutch. In the circumstances we can only assume that they did not take Messrs. Broadbent into their confidence.

Brittain's Electric Motor Co.
P. F. Brittain.

London, *March 11th*, 1924.

My attention has just been drawn to the recent letters on the above subject. With Mr. Broadbent's remarks I quite agree. In my experience, when a centrifugal clutch does give trouble, it is generally due to wrong information supplied when ordering the clutch. For instance, to the load being much greater, or the speed much less (or both) than stated.

The simple, efficient, and robust squirrel-cage motor is an ideal machine when run at full speed, and will yet come fully "into its own." With a good centrifugal clutch of sufficient capacity to deal with the maximum load, which frees the motor of any load up to full speed, full load can be started with a very reasonable current.

I have designed such automatic centrifugal clutches in sizes up to 600 b.h.p., which have for years run very satisfactorily. They were rather expensive to make, and perhaps apt to appear fierce if the starting load was too easy.

I am going to predict that a new type of automatic clutch which will be extremely suitable for squirrel-cage motors, single or polyphase, and be quite moderate in cost, will be available this year.

I quite agree with Mr. Brittain that supply authorities act unfairly (I am told—illegally!) in limiting a machine rather than the starting current. It suggests putting the cart before the horse! The ladies, bless 'em, are not the only creatures of fashion, are they, Mr. Editor?

A. E. Woodhouse.

London, *March 11th*, 1924.

German Co-operation.

At the I.E.E. informal meeting on March 10th it was stated that it was not proposed to invite German engineers to the next meeting of the International Conference on Extra-High-Pressure Lines, which will be held in Paris in June, 1925. The reason given was that the French people do not like the German people.

This policy strikes me as foolish and narrow-minded. After all, it is an international conference, and its object is to promote the growth of the electrical industry by means of friendly discussion of problems (and their solutions) found in various countries. Surely the experiences of German engineers would be of some value to the Conference. Their exclusion will certainly not ease the way to world peace which, I take it, is the desire of every engineer.

H. Horowitz.

London, *March 11th*, 1924.

Self-Exciting Alternators.

With reference to the article on "Self-exciting Alternators," published in the ELECTRICAL REVIEW of February 8th, Mr. Hill believes that the self-exciting alternator described is the same as that referred to by Arnold and La Cour in "Wechselstromtechnik," Volume V, part I, page 575 and following pages. I differ in opinion, and venture to assert that the "Doppelfeldgenerator" invented by Mr. Ziehl, referred to in the above text-book, is quite a different thing altogether. Mr. Ziehl applied for his patent originally in Germany, No. 157,704, dated October 28th, 1903, and then for a patent of addition on June 16th, 1904. The contents of these two specifications are embodied in the British Patent No. 19,168 of the year 1904, when his idea had already been taken up by the firm "Schwartzkopff" of Berlin, and in the American Patent No. 781,706 of February, 1905. As Mr. Hill states, this machine depends on an external source of wattless magnetising kVA, which, together with the load current, is shared equally by the stator and rotor windings, therefore the machine cannot be self-exciting. The machine that I described is self-exciting, and the current will not die away when the auxiliary source of alternating current, used for the start only, is disconnected. To prove it, I will refer Mr. Hill to the original drawing. He must admit that under certain conditions the two generators G and A can be synchronised. Then by increasing the resistance R_1 and decreasing R_2, the load on the auxiliary generator is gradually taken up by the main generator, and when almost the whole exciting current is supplied by the stator winding of the main generator, switch S, can be opened, leaving the generator under self-exciting conditions. The machine can then be accelerated and its voltage accordingly increased.

Mr. Ziehl tried to invent a double exciting field generator, not a self-exciting generator, which can only be obtained by making one winding of the machine, either in the stator or in the rotor, responsible for the magnetising current, and the other winding for the generated current. My statements are, I think, simple, while those of Mr. Ziehl, as can be gathered by reading his British specification at the Patent Office, are extremely complicated, as he considers a generator with two energy-giving windings, and with two field windings, and in the end he states that the field windings can be contained in the energy-giving windings. This is far from practical, and although his "Grosse Komplicazione" was taken up by an important German firm, the double-field generator has been a failure. The self-exciting alternator is possible when one winding of the machine is the exciting winding and the other is the energy-giving winding; but when the two windings are of a similar construction and supposed to perform the mixed operation of being exciting windings and energy-giving windings at the same time, the machine cannot work satisfactorily.

I did not pretend in my article to show something of purely academical interest, but was endeavouring to describe a machine which I consider to be eminently practicable.

F. Contell.

London, *March 12th*, 1924.

Danger of Erecting Aerials near Overhead Distribution Wires.

Referring to the last line of the note that appears on page 377 of the March 7th issue of the ELECTRICAL REVIEW under the heading "Radio Notes," which reads: "A rather roundabout way of getting at the offenders," our notice attached to our poles was not intended to get at the offenders, but to prevent budding listeners from offending.

The offenders, either having erected their aerials in safety or having been shocked, have been dealt with.

C. T. Allan,
Assistant Manager, South Wales Electrical Power Distribution Co.

Cardiff, *March 10th*, 1924.

The History of Fused Silica.

I notice in your issue of February 15th, in a report of the paper on "The History, Development, and Commercial Uses of Fused Silica," read by Sir Richard A. S. Paget, Bart., before the Royal Society of Arts on January 30th, that I am taken to task for not having mentioned or gone into more detail as to the history in the brief resumé which I gave, and the inference is that I was ignorant of all the work which had been done in Europe since 1902. The fact is, I had supposed that everybody knew of the great work that had been done by the Thermal Syndicate in the production of wonderful pieces of fused quartz suitable for chemical conduits, chemical vessels, &c. In fact, I knew that the whole art of concentration of sulphuric acid by the cascade method was based upon fused quartz vessels arranged in cascade. Being familiar with the sulphuric-acid industry from early days, I recognised the great step which had been taken in replacing platinum, glass, and porcelain, formerly used for such vessels. I remember very distinctly exhibitions made by the Thermal Syndicate in New York, showing the advances which had been made. Perhaps my mistake was in not alluding to these matters, which I supposed must be, for those interested, common knowledge.

I confess that I was unaware that Sir Charles Parsons had, as early as 1888, described his experiments on the fusing of silica sand by an electrically heated carbon rod embedded therein under high pressures. In my later experiments at *atmospheric* pressure, I found that there was no tendency, as the paper seems to imply, for the fused silica to stick to the carbon rod. There was always a space around the rod, so that the rod could be readily withdrawn after the melting, and we found also that the thickness of the tube around the carbon depended on the proper manipulation of the heat, so that great thicknesses were obtainable.

I ought to explain, in conclusion, that the paper which

appeared in the issue of the *General Electric Review* of February, 1923, on "Silica Glass or Fused Quartz," was prepared in response to those within the General Electric organisation who desired to know more about what was being done at our Lynn laboratories. It was not intended as a complete paper on the subject, and was rather confined to those operations which we were then carrying on, and which we are still carrying on in new fields.

May I add that I have, for a very long period of years, had entire confidence that for many uses the remarkable material, fused silica, either in the coarser form or in the finer, clear variety, would find extended uses, a confidence which has shown itself not to be misplaced.

Let me state that I have had great admiration all along for the work done by Dr. Hutton, and following him, The Thermal Syndicate, and his attempted working on the material on what may be called a very large scale, and with a success which must be known to all who have had any acquaintance with the development.

Elihu Thomson.

West Lynn, Mass.
March 1st, 1924.

A Potential Problem.

Depending upon where the copper ring is placed in the alternating magnetic field, there will exist an e.m.f. and a p.d. or an e.m.f. only, with no p.d.

I presume that it is intended that the ring should occupy such a position that the polar axis coincides with the axis of the field, the plane of the ring being at right angles to it. Under this condition all parts of the ring are cut at the same instant by flux of the same density moving at the same rate and in the same direction, *i.e.*, radially inwards or outwards.

I have from time to time been considered pedantic because I have always insisted upon the difference between an e.m.f. and a p.d., and objected to the careless use of the terms in arguments and discussions.

"F.A.G." has presented a nice problem for testing the appreciation of the difference. In the conditions I have given, there will be no p.d. in the ring, but there will be an e.m.f. The ring may be regarded as an infinite number of small cells joined in a series ring by connecting straps having no resistance. Each part of the circuit has just sufficient e.m.f. to force the current through its own internal resistance; there is, therefore, no external p.d. at any part of the ring. The external circuit to any cell is the remaining cells in the circle. And this remaining portion has an internal e.m.f. which is sufficient to force the current flowing through itself, leaving no external p.d. in turn. Thus each cell supplies an e.m.f. sufficient to supply its own current, receiving nothing from, and giving nothing to, the circuit external to itself.

F. L. Best.

London, *March 15th*, 1924.

What is a Megger?

Mr. Borlase Matthews takes me to task for not explaining, in my recent letter to you, the meaning of the words "ohmmeter" and "generator" employed in my explanation of the precise connotation of the term "megger"; holding, apparently, that they are equally obscure to his "electrical man." An electrical man may be forgiven for not knowing the precise significance of a word invented to serve as the name of a proprietary article; but ignorance on his part of the meaning of such elementary terms as "ohmmeter" and "generator" would argue so defective a technical training that I should hesitate to attribute it to him.

E. B. Vignoles.

London, *March 13th*, 1924.

Customs Tariffs—Canada.

In your issue of August 31st last, p. 335, under the above heading, the duty for cables—telegraph, telephone, and electric light—is given as A.V. 17½ per cent.

Since the publication of this information, we have had occasion to tender for various cables for shipment to Canada, and have included the above rate of duty.

As a result of some correspondence with our agent in Montreal regarding the question of duty payable, our agent has approached the Department of Customs and Excise, Ottawa, with the result that we are now informed that the rate of duty above mentioned comes under tariff item 408 for "wire rope, stranded or twisted wire, clothes line, picture and other twisted wire, and wire cable, n.o.p.," whereas electric wires and cables should come under item 407, and be subject to 20 per cent. A.V. duty.

We think you may like your attention drawn to this matter.

W. T. Henley's Telegraph Works Co., Ltd.
W. Bishop,
London, *March 13th*, 1924. *Sales Manager.*

Letters have been received from Messrs. H. Hunt, W. Y. Minton, R. Leach, and "A. H. S."

Business Notes.

Bankruptcy Proceedings.—Emmott & Co., 249, Goldhawk Road, Shepherd's Bush, London, electrical engineers, &c.—The receiving order in this case was made on November 12th, 1923, upon a creditor's petition, the act of bankruptcy alleged being non-compliance with the requirements of a bankruptcy notice duly served on the debtor, and on December 7th an order was made by the London Bankruptcy Court adjudging bankrupt Robert Emmott, trading as Emmott & Co. At the first meeting of creditors Mr. A. E. Quaife, I.A., was elected trustee to administer the estate. A sitting for the public examination of the debtor was appointed to be held on March 12th, before Mr. Registrar Hope, when Mr. E. Parke, official receiver, having reported that the debtor had not surrendered to the proceedings, his Honour adjourned the examination *sine die*.

C. W. Stocken & C. Fink (Wyndham Radio Supplies), 80, Redcliffe Street, Bristol.—Last day for proofs for dividend, March 25th. Trustee, Mr. J. P. Emett, 18, Nicholas Street, Bristol.

E. W. J. Whitelock, electrical engineer, 7, Cheapside, Luton.—Last day for proofs for dividend, March 25th. Trustee, Mr. T. Keens, 11, George Street West, Luton.

N. Williams, M. Williams, & W. Cook (British Radiophone Co.), makers of wireless apparatus, Downing Street, Bulwell, Nottingham.—Last day for proofs for dividend, March 26th. Trustee, Mr. L. A. West, official receiver, 4, Castle Place, Nottingham.

E. L. Harris, electrician, 6, Short Street, Swansea.—Receiving order made March 11th, on debtor's own petition.

C. L. Lote, plumber and electrician, 8, Bray Street, Willenhall, Stafford.—Receiving order made March 11th, on debtor's own petition.

T. G. H. Wiley (Wiley & Co.), electrical engineer, Bradford Road, Stanningley.—Last day for proofs for dividend, March 28th. Trustee: Mr. W. Durrance, official receiver, 12, Duke Street, Bradford.

P. C. Letherbarrow (Letherbarrow Bros.), electrical contractor, 1, Church Lane, Banbury.—First and final dividend of 2½d. in the £, payable at 1, St. Aldate's, Oxford.

M. O. Heckels, electrical wholesaler and agent, 643, Welbeck Road, Walker, and Star Buildings, Northumberland Street, Newcastle-upon-Tyne.—First and final dividend of 2s. in the £, payable March 24th, at Pearl Buildings, 4, Northumberland Street, Newcastle-upon-Tyne.

Company Liquidations.—Catchpole & Maurice, Ltd.—A petition for the winding-up of this company has been presented to the High Court, and will be heard in London on March 25th.

H. Haydon & Co., Ltd.—A petition for the winding-up of this company has been presented to the County Court of Leicestershire by the General Electric Co., Ltd., of Magnet House, Kingsway, W.C., and will be heard by the Court sitting at the Castle, Leicester, on April 25th.

Midget Lamp Co., Ltd.—Winding up voluntarily. Liquidator, Mr. L. Jacobs, 3-5, Queen Street, E.C. A meeting of creditors was called for March 17th, at 85, London Wall, E.C. Particulars of claims to the Liquidator by April 1st.

British Road Train Corporation.—First meeting of creditors and contributories, March 21st, at Carey Street, W.C.

Metropolitan Electric Wire Co., Ltd.—A petition for the winding-up of this company has been presented to the High Court by Messrs. H. C. Rowland & Co., Ltd., of 3, Cloak Lane, E.C.4, and will be heard in London on March 25th.

East Somerset Agricultural Power Co., Ltd.—Winding up voluntarily. Liquidator: Mr. G. McD. Ingram, Bruton, Somerset. Meeting of creditors March 21st, at the Blue Hall Hotel, Bruton, Somerset.

A.E.G. Electrical Co. of South Africa, Ltd.—First and final dividend of 13s. 0½d. in the £1. Ex-enemy creditors payable at Carey Street, W.C.

The Park Royal Engineering Works, Ltd., Cumberland Avenue, Park Royal, London, N.W., electrical and mechanical engineers.—A compulsory winding-up order was made against this company on a creditors' petition, and last week the first meetings of the creditors and shareholders were held at the London Bankruptcy Buildings, Carey Street, W.C.

Mr. G. D. Pepys, Official Receiver, reported that the company was registered as a private company, on April 17th, 1914, to carry on business as electricians and mechanical engineers. The nominal capital was originally £20,000, divided into 19,300 preference shares of £1 each, and 14,000 ordinary shares of 1s. each. This was, however, increased in February, 1920, to £40,000, by the creation of 20,000 8 per cent. cumulative participating shares of £1 each. The promoters of the company were A. G. Morrish, G. J. L. Nicholson, and H. M. Bailey; they were also the first directors, while the two last-named were appointed managing directors at a remuneration of £500 per annum each, plus directors' fees. In February,

1920, their remuneration was increased to £900 per annum each, which, however, included directors' fees. The company seemed really to have been formed to acquire the business of Spagnoletti, Ltd., which was established in 1851 for the purpose of manufacturing telegraph instruments. They held certain premises at Shepherd's Bush, and it appeared that additional capital was required for the purpose of buying new works. Hence the formation of the present company. The business was acquired by this company under an agreement dated April 29th, 1914, under which the company bought the whole of the issued debentures in Spagnoletti, Ltd., amounting to £12,500, for which they paid a consideration of £15,000, to be satisfied by the allotment of fully-paid shares. On the same date the company entered into another contract with the shareholders of Spagnoletti, Ltd., which related to the enforcement of rights under powers contained in the debentures, and provided that, if the company had not before a certain date appointed a receiver, the shareholders would consent to an agreement with any receiver who might be appointed for the purchase by the company of the assets and business of the Spagnoletti Co. In 1914 this company took up a further £3,000 of debentures in Spagnoletti, Ltd., and on December 21st, 1914, appointed a receiver. An agreement was then entered into with the receiver for the purchase of the goodwill of the business of Spagnoletti, Ltd., together with the plant, machinery, office furniture, and all property except the out-of-date works at Shepherd's Bush and certain small specified items; the consideration was the release by this company of Spagnoletti, Ltd., from all claims under the debentures which had been taken over. Further, the company was to discharge the liabilities of Spagnoletti, Ltd., except the amount due to Mr. H. H. Konig, while the amount due to the bank was placed under a limitation. In April, 1914, this company also bought from the vendors some freehold land in Cumberland Avenue for £1,000, on which they erected some new works, where they had since carried on business. Those buildings cost over £9,000 to erect. The company began business on January 1st, 1915, which was the date from which it had actually taken over from the Spagnoletti Co. To provide the necessary capital, £15,000 was raised on debentures, the interest payable being 5 per cent. per annum, and these were secured by a trust deed which gave a floating charge on all the company's property and a specific charge on the land and premises at Park Royal. With reference to the trading of the company, the accounts showed the following results:—Profits to the end of 1915, £1,931; 1916, £3,027; 1917, £4,498; 1918, £3,603; and losses: 1919, £2,676; 1920, £3,396; 1921, £3,065; and for the 18 months until the end of June last a further loss of £31,148. No dividend had been paid on the ordinary shares, but one of 7 per cent., which absorbed just over £1,000, was paid on the preference shares for 1917. In February, 1920, further capital was introduced by the issue of 10,000 of the then newly-created 20,000 participating shares, and in January, 1921, a loan was obtained from the bank of £15,000 secured, as to £9,000, by debentures which were surrendered by the holders for that purpose, and £6,000 by second debentures. Then third debentures at 8 per cent. per annum interest were issued to those who had surrendered the first debentures. On October 19th last the trustee for the first debenture holders appointed Mr. John Davey, 3, London Wall Buildings, E.C., as receiver, and he had since carried on the business. Mr. Nicholson chiefly attributed the company's failure to loss sustained through the failure of a motor company which owed this company £39,000 for goods completed, but not delivered, and also in course of manufacture; the ultimate loss through that transaction was estimated at £27,000. He added that the trading loss in 1919 was due to the moulders' strike, as a result of which the company was unable to complete contracts, and the company had also been adversely affected by the trade depression which began in 1921 and lasted until 1922, and to a lock-out which existed for over three months in 1923. A statement of the company's affairs had been submitted, and it disclosed gross liabilities £78,764, of which £19,287 was due to 314 unsecured creditors; £397 fully secured; £27,214 partly secured (the security being valued at £130); £985 as preferential; and £30,879 as loans on debenture bonds, which were expected to rank to the extent of £7,387, making the total liabilities expected to rank £53,759. The assets were estimated to realise a gross amount of £24,477, but they were all absorbed by the payment in full of the preferential claims and by the satisfaction in part of the claims of the debenture holders. A total deficiency of £78,759 was disclosed with reference to the shareholders. The amounts which he had mentioned regarding the assets were, he understood, the break-up prices, but he had been informed that efforts were being made for a sale of the business as a going concern, in which case it was possible that the assets would produce a very much greater sum.

Mr. Davey's partner informed the meeting that advice had now been given by his firm to the trustee for the debenture holders that in their opinion the time had come for a sale of the assets to be effected. Up to the present no offer had been received; indeed, they had not actually moved to sell, but he feared that there would be no surplus to come to the unsecured creditors from any sale that might be effected. In fact, he doubted whether it would be possible to obtain a price more than enough to pay the first, second, and third debenture holders.

The liquidation was left in the hands of the Official Receiver.

The following are the principal creditors (£20 and over). Unsecured:—

	£
Angus, G., & Co., Ltd.	49
Aston Chain & Hook Co. ...	226
Anglo-American Abrasive Co., Ltd.	43
Atherton, G. A., & Co.	49
Beecroft, Sons & Nicholson ...	19
Brush Electrical Engineering Co., Ltd.	170
Bolton, Thos., & Sons, Ltd. ...	149
Bullers, Ltd	165
Buck & Hickman, Ltd. ...	139
Burns, J., Ltd.	49
British Central Electrical Co., Ltd.	28
Bellows, Jno.	252
British Felt Co., Ltd.	23
Barnes Aluminium & Bronze Co., Ltd.	173
Butler, Spragg & Co., Ltd. ...	26
Brown Bros., Ltd.	26
British Thomson-Houston Co., Ltd.	46
Clark, W. T., & Co., Ltd. ...	38
Clifford, Chas., & Son, Ltd. ...	46
Cary, Hallewell & Co.	33
Canning, W., Co.	44
Cheap Wood Co., Ltd.	20
Commissioners of Inland Revenue	524
Dacier, Ltd.	179
Davis & Timmins, Ltd. ...	480
Doulton & Co., Ltd.	72
Diamond Fibre Co., Ltd. ...	47
Delta Metal Co., Ltd.	272
Elliott Bros., Ltd.	213
Ealing Park Foundry	28
Eagle Foundry Co.	111
ELECTRICAL REVIEW, Ltd. ...	40
Fletcher J., Ltd.	39
Ferranti, Ltd.	559
Farmer, Stedall & Co.	26
Foote & Milne, Ltd.	30
Fuller, W. F.	20
General Electric Co., Ltd. ...	36
Gedge & Co.	36
Gaskell & Grocott	154
Grey & Martin	37
G.W. Railway	67
Griffiths Bros. & Co.	25
Glanford, C. N.	24
Goldby, H.	121
Ganeval & Callard, Ltd. ...	47
Griffiths, I., & Sons	73
Huth, Fredk., & Co.	2,053
Haywards, Ltd.	178
Hatch, Geo., Ltd.	32
Horton, Jas., Ltd.	32
Henley's, W. T., Telegraph Works Co., Ltd.	61
Hightensite, Ltd.	82
Herbert, Alfred, Ltd.	56
Jenner & Sons	44
Johnson & Phillips, Ltd. ...	249
Johns, C. L.	54
Kent, G., Ltd.	75
Konig, H. H.	4,358
London Electric Wire Co., Ltd.	176
L.M. & S. Railway	37
Litholite Insulators, Ltd. ...	71
L.E.P. Transport, Ltd. ...	146
Laveng, R. D.	38
Maddocks, Jno., & Co., Ltd. ...	31
Metropolitan-Vickers Electrical Co., Ltd.	77
Mayle, Frank, & Sons, Ltd....	134
Morrish, Grant & Co.	85
Moss, T., & Co., Ltd.	108
Micanite & Insulators, Ltd. ...	412
Mica Mfg. Co., Ltd.	99
Mosers, Ltd.	49
Meredith, H. W.	89
Marks, John, Ltd.	30
Matthews, Edward, Ltd. ...	36
Matthews, Ernest, & Co. ...	371
McKechnie Bros., Ltd.	21
McTrusty, H.	23
Morrish, A. W. G.	447
Nettlefold & Sons, Ltd. ...	58
Nalder Bros. & Thompson, Ltd.	58
Newby & Sons	69
Oakey, Jno., & Son, Ltd. ...	24
Prel Connor Telephone Works, Ltd.	33
Parry, Jno., & Co., Ltd. ...	60
Premier Electric Control Co., Ltd.	26
Prices Co., Ltd.	57
Palmers Shipbuilding & Iron Co.	21
Pomeroy Foundry, Ltd. ...	233
Pritchett & Gold & E.P.S. Co., Ltd.	104
Rudder & Raynes, Ltd. ...	43
Rintoul, J.	24
Scott Insulated Wire Co., Ltd.	30
Siluminite Insulator Co. ...	50
Sun Electrical Co., Ltd. ...	32
Still, W. M., & Sons, Ltd. ...	39
Senier & Co.	76
Star Foundry Co., Ltd. ...	52
Swift, Levick & Sons, Ltd. ...	82
Snow, H. J.	24
Thomas, A.	25
Turner Bros., Ltd.	21
Thomas, Bertram	517
Telegraph Condenser Co., Ltd.	90
Thomas & Co.	163
Tannahill & Co. Ltd.	46
Tollitt & Harvey, Ltd. ...	125
Terry, Herbert, & Sons ...	27
Visible Writing Machine Co., Ltd.	25
Weston Electrical Instrument Co., Ltd.	29
Webb, Percy, & Co.	56
Womeraley Son	23
Wilmer & Sons	193
Wood Wool & Fibre Co., Ltd.	26
Warren, C.	31
Woods, R. A.	40
Wagham, C. H.	323
Willesden U.D.C.	101
Fully secured	397
Partly secured (security £130)	27,214
Preferential	985

Dissolutions of Partnership.—E. MCCALLUM DAY & Co., dealers in electrical accessories, 16, City Chambers, Broad Street, Birmingham.—Mr. E. McC. Day and Mr. W. A. Williams have dissolved partnership.

FOOKES & Co., plumbers and electricians, 24, Gladys Avenue, Portsmouth, and 47, Frensham Road, Southsea.—Mr. E. Fookes and Mr. A. V. Kidd have dissolved partnership. Debts will be attended to by Mr. E. Fookes, who will continue to carry on business at Gladys Road, while Mr. Kidd will carry on a like business at Frensham Road.

L. R. SMALLWOOD & Co., electrical engineers, 29, Magdalen Road, and 16, Newstead Road, Liverpool.—Mr. L. R. Smallwood and Mr. H. Sanders have dissolved partnership. Mr. H. Sanders, of 16, Newstead Road, will attend to debts. Mr. L. R. Smallwood will continue the business in his own name.

Trade Announcements.—MR. HORACE GRENSTED has opened a wireless business at Radio House, 55, High Street, Sittingbourne.

MR. F. GREENHALGH, electrical engineer, is transferring his business to 65, Market Street, Church (near Blackburn).

In our "New Companies Registered" section to-day we give particulars of a new company—CARD CLOTHING & BELTING, LTD.—in which the businesses of Fleming, Birkby & Goodall, Ltd., and various other firms are amalgamated.

MR. HAROLD MORGAN has commenced business as an electric lighting engineer at Warick Farm, Ash Vale, Aldershot.

MESSRS. B. BARNETT (ELECTRICAL ENGINEERS), LTD., notify the removal of their head office to 331a, Romford Road, Forest Gate, E.7. Catalogues and lists are asked for.

MESSRS. TREVELYANS (BIRMINGHAM), LTD., have appointed Messrs. Hook & Willis, Ltd., of 74, Goding Street, Vauxhall, London, S.E.11, as their representatives in London and the provinces.

Catalogues and Lists.—SUFFOLK IRON FOUNDRY (1920), LTD., Gipping Works, Stowmarket.—A booklet describing and containing instructions for the use of "S.I.F." welding rods and fluxes (oxy-acetylene).

NEOCELLON, LTD., Garratt Lane, Wandsworth, S.W.18.—A booklet describing "Cellon" varnishes, lacquers, and insulating cements for electrical and other purposes, together with a card bearing samples of these products.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—March price list of electrical supplies of all kinds, including wiring materials, lighting fittings, switchgear, domestic appliances, and cables.

Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.—Exide battery service technical letter No. 3 for motor-car dealers, dealing with "replacing evaporation" or the addition of pure water to batteries.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—March list of motors and dynamos in stock.

The Airedale Electrical and Manufacturing Co., Ltd., Ryan Street, Bradford.—Illustrated descriptive leaflets dealing with oil-immersed star-delta starters, &c., and air-cooled auto-transformer starters.

Messrs. Smith & Ansell, Ltd., Stockfield Road, Acocks Green, Birmingham.—An illustrated price list of lighting pendants, chandeliers, standards, &c.

Messrs. Johnson & Phillips, Ltd., Charlton, S.E.7.—A well-produced list of cab-tire-sheathed cables of many types and sizes.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—Circular 1,790/1, dealing with motor equipment for main rolling mill drives. The publication contains a number of views of actual installations, of which there is a total of 150,000 h.p. (normal).

Measurement, Ltd., 34-38, Provost Street, City Road, N.1.—List H.M. describing a new type of house-service mercury-motor meter for direct current. Illustrated.

Electrical Utilities, Ltd., Tudor Works, Park Royal, N.W.10.—A priced and illustrated leaflet advertising "Tudor" and "Grecian" fires.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W.1.—Pamphlets 720 A., dealing with mine-shaft signalling apparatus; 830 A., pyrometers for measuring the temperature of the exhaust gases from internal-combustion engines; and 840 B., describing electrical distance thermometers for use on board ships. Fully illustrated.

Messrs. Watson & Sons (Electro-Medical), Ltd., Sunic House, Parker Street, Kingsway, W.C.2.—Bulletin 60, describing generating apparatus for ultra-violet radiation for therapeutic use.

Presspahn & Electrical Insulating Material Manufacturing Co., Ltd. (formerly H. Weidmann), Rapperswil, Switzerland.—An illustrated catalogue of presspahn, glass, leatheroid, ebonite, compound, and other insulating materials, for which the English agents are Messrs. D. M. Henderson & Co., Ltd., 141, Moorgate, E.C.2.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—A series of publications dealing with various apparatus:—D.L. 47/1-1, d.c. brake solenoids; D.L. 91/1-1, steel-clad motor control pillars; D.L. 296/1-1, flame-proof switchgear; D.L. 256/1-1, oil circuit-breaker; B.I.L. armour-clad switchgear—draw-out type; and B.I.L. 82/1-3f, auto-transformer motor control pillar.

The Weston Engineering & Disposals, Ltd., 2a, Alexandra Road, Moss Side, Manchester.—A map of Manchester and district bearing an advertisement of the company's boilers and repairing service.

Messrs. Drake & Gorham, Ltd., 67, Long Acre, W.C.2.—An illustrated price-list of "DGW-Croydon" "Electrolux," "Nilfisk," "Eureka," and "Torrington" vacuum cleaners.

Book Notices.—"The Municipal Year Book of the United Kingdom for 1924." (Pp. 1+694.) London: The Municipal Journal, Ltd. Price 15s. net.—Not much more can be said of an annual publication than that it "has been brought up to date." In the case of this year book a great deal of work is implied in this simple statement, for many sections are entirely changed from year to year. For instance, the particulars relating to the trading departments of municipal authorities, which include a very good table showing in condensed form the results of working during 1922-23 of the electricity undertakings, have to be compiled afresh for each edition. The personnel of local government bodies is also a changing feature, and therefore we consider that the work involved and the undoubted usefulness of the publication fully justify its price.

Laidlow's "Practical Speed and Feed Guide and Diary for 1924." Pp. 48+diary. Sheffield: Mr. C. Laidlow, 322, Petre Street. Price 3s.—This special diary contains a large number of tables of speeds and diameters for lathes, screw-cutting machines, boring machines, drills, taps, &c., as well as speeds and feeds for milling and grinding machines, planers, slotters, saws, &c. Other data tabulated relate to fits and limits of error, and tables of logs, antilogs, and other mathematical functions are given. The data relate to high-speed steel with cutting lubricant, and are said to be based on many years' practical experience; it is claimed that with their aid the output of several of the largest works in England has been trebled.

"Broadcast Listeners' Year Book, 1924." (Pp. iii+79.) London: Radio Press, Ltd. Price 1s. 6d.—The many thousands of "listeners-in" to the excellent programmes which are broadcast by the B.B.C. will be interested to know how it is all done, and this little year book supplies the answers. The various stations are briefly described; the work of the company is reviewed by Mr. A. R. Burrows; Mr. P. P. Eckersley explains the working of the system; 2 LO receives special mention in a brief sketch; there is a "Children's Corner" contributed by "Uncle Caractacus"; hints on the purchase and care of receiving sets appear; and the reader is introduced to the personnel of the broadcasting stations. This note does not exhaust the list of contents, but is sufficient to indicate the nature of the book.

"The *South African Mining and Engineering Journal* Year Book and Directory." (Pp. 366 + lxvi.). Johannesburg: South African Mining Journal Syndicate, Ltd. Price 10s. 6d.—The principal subject of this directory is mining, and in this direction the information given appears to be of a very exhaustive character. The surveys of the mining industry as a whole, and its many parts, are historical, geological, and financial. The numerous illustrations include many interesting reproductions showing the machinery in use at mines. The statistical section contains a table showing the electrical output during 1922, by provinces, together with the way in which this was distributed. This shows that the electrical load at mines is the mainstay of the systems in the Transvaal where the bulk of the electricity was generated. From a list of machinery and plant installed during 1922 it is seen that the principal item was "Electric generators and engines, hoists, locomotives, and motors," which accounted for £154,574 out of a total of £1,010,842. In another list, however, the purchase of electrical machinery, spares, and fittings, by the mines, during 1922, is shown at £423,478. At the end of the volume is a list of engineering (including electrical) and iron and steel firms; a list of the principal consulting engineers; a section showing the representatives of over-sea manufacturers (British and foreign) in the Union; and a list of buyers for mining companies. This is not intended to be an electrical year book, but it should be of considerable assistance to suppliers of electrical goods and apparatus in directing them to the right firms or persons.

"Colliery Electrical Engineering," by G. M. Harvey. Pp. xi+387; figs. 153. London: Sir Isaac Pitman & Sons, Ltd.

"What is Bribery?" A record of upwards of 400 convictions. London: Bribery and Secret Commissions Prevention League. Price 6d.

For Sale.—St. Helens Corporation Electricity Committee has for disposal two 300-kW Willans-E.C.C., and one 200-kW Willans-Mather & Platt generators, with one condenser, steam and exhaust pipe and valves; Hackney Borough Council Electricity Department invites offers for surplus steam engines and condensing plant at the Millfields Road Power House, Clapton; Messrs. H. Butcher & Co. will sell by auction on April 1st, at 8, Lambeth Palace Road, S.E.1, extensive power transmitting machinery and engineers' stores, &c., also the long lease of the warehouse premises; Assets Auction Co., Ltd., will sell by auction on March 26th, at 85, Newington Causeway, S.E.1, a number of electric motors, fans, wireless and electrical parts, &c. (See our advertisement pages to-day.)

Power Station Publicity.—We have received from the Engineer and Manager of the West Ham Corporation Electricity Department a copy of a useful monthly publication—the "West Ham Power and Factory Gazette"—which, in addition to setting forth the advantages of electricity for industrial and other purposes (giving particulars of charges, &c.), contains a list of vacant factories in the district with details of the facilities available. The publication is illustrated with views of the works of West Ham power users.

Railway Orders and British Prices.—In the course of his speech at the annual meeting of the L. & N.E. Railway Co., Mr. W. Whitelaw, the chairman, said that many people imagined that they could employ their reserves in such new works as the electrification of the lines and the building of new docks. Of course such was not the case, and all work of that kind would be chargeable to capital. Later he said that in considering the question of capital expenditure railway companies must take fairly long views, and endeavour to provide facilities slightly in advance of trade requirements, and a sound railway policy lay somewhere between undue optimism and unworthy fear regarding the prospects of the re-establishment of national prosperity. Under existing circumstances in railway, as in national affairs, sound economy was of the first importance, and should be the guiding principle of all policy. That some recent tenders had revealed the cost of iron and steel manufactures in this country to be very much higher than that at which they could be purchased on the Continent, was somewhat ominous for the recovery of these trades. Their company was deeply interested in the prosperity of the iron and steel trades of the North of England, the Midlands, Lincolnshire, and Scotland, but there must be a limit to the price which they could afford to pay over the Continental price in order to assist in restoring prosperity to the home trade, and they would have to continue to give the most anxious consideration to this difficult and involved question. He added: "We have felt ourselves compelled during the last few weeks to place an order for wheels and axles on the Continent, as the lowest British price was 70 per cent. higher than the Continental price. In this connection you may have observed that within the last week or two orders for locomotives for India and Egypt have been placed with German and Italian firms respectively at prices far below the lowest quotations of any British firm. These differences of home and foreign costs are probably due to the differences in the rates of taxation, wages, and currency value at home and abroad; how these differences can be reduced or abolished is not for me to discuss, but I have felt it my duty to make clear the facts as they exist."

Works Football Match.—A football match was played between the "Minerva" team of Messrs. Pinchin, Johnson and Co., Ltd., and the "Bramtoco" team of the British American Tobacco Co. at the Oxford Circus Football Ground, Wembley,

on March 8th. The "Bramtoco" team won by three goals to one, and after the match both teams were entertained to a dinner and concert at the "Trocadero."

New Belgian Companies.—Fédération d'Enterprises de Transports et d'Electricité (Brussels), construction of railways, tramways, &c.; 12,250,000 fr. Electrolux (Brussels); 1,000,000 fr. Radio Belgique (Ixelles), working of telephone and wireless posts in Belgium and Luxembourg; 1,250,000 fr.

Les Ateliers Mécaniques (Les Hayettes), manufacture, sale, and installation of electrical and other apparatus, mining and other lamps, &c.; 2,500,000 fr.

Société Coloniale d'Electricité (Elisabethville, Belgian Congo), all operations connected with the generation and use of electricity, water, and gas, principally in the Belgian Congo; 3,000,000 fr.

Electricité Olivier (Saint-Gilles-Bruxelles), electrical installations purchase, and sale of electrical material; 200,000 fr.

General Radio (Antwerp), trade in telephone and wireless material; 100,000 fr.

Electro-Précision (Molenbeck St. Jean), repair of electrical instruments, &c.; 78,500 fr.

Comptoir Central d'Electricité (Namur), trade in electrical materials; 160,000 fr.

Electricité de Warsage et Extensions, production and distribution of electric current; 200,000 fr.

Les Ateliers Gilles Fils et F. Vander Schueren (Anderlecht), trade in machinery, tools, and instruments; 300,000 fr.

Garage Zénith (Schaerbeck), trade in electrogenes, mechanical and electrical material, &c.; 110,000 fr.

Compagnie Continentale pour l'Exploitation de Brevets Industriels (Brussels), the working of industrial patents of all kinds; 100,000 fr.

Les Piles Sessa (Brussels), manufacture and sale of dry cells, &c.; 600,000 fr.

Veuve Brant-Graindorge et Cie. (Antwerp), manufacture and sale of electrical material; 350,000 fr.

Manufacture Nationale Radioelectrique (Liége), manufacture and sale of wireless and other electrical material; 75,000 fr.

Fabrique d'Appareils Electriques et Mécaniques (Brussels), manufacture and sale of electrical and mechanical appliances; 200,000 fr.

Construction, Etudé et Ouvraison (Brussels), laying and working of water, gas, and electric conduits; 350,000 fr.

Engineering Conditions in Johannesburg.—The improved tone which has been noted in Johannesburg commercial, mining, and engineering circles in recent weeks continues; inquiries are being placed much more freely by the mining houses, municipalities, railway, and other public departments, and with the extension of the electrification of the railway system, for which tenders are now being received, there will undoubtedly be a great impetus to engineering in all branches. It is expected that the electric working of a portion of the Natal line will commence in October. A good deal of construction work is now being begun at the mines, the position of the industry now warranting this expenditure. At Consolidated Main Reef a 1,800-h.p. hoist is being installed, which is believed to be the biggest electric motor taken underground on the Rand.—*Reuter's Trade Service* (Johannesburg).

Recent Contracts.—Among some of the larger contracts obtained by the GENERAL ELECTRIC CO., LTD., for "Osram" lamps of various types are the following:—Southern Railway, vacuum, gasfilled, and carbon-filament patterns; Brighton Corporation, vacuum and gasfilled; Admiralty, m.f. mast-head signalling lamps, and standard and special types; Liverpool Corporation, traction lamps; and the British Empire Exhibition authorities, projector-type lamps for flood-lighting buildings.

THE SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., have received large orders for helical traction lamps for the Brighton Corporation, and for vacuum-type lamps for the Liverpool Corporation.

Large lamp contracts have also been placed with the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., including the following:—L. & N.E. Railway, vacuum m.f. train lighting lamps; Southern Railway, m.f. lamps; Admiralty, carbon-filament lamps; Glasgow Corporation, vacuum lamps; L.M. and S. Railway and L. & N.E. Railway, continuous orders; and the Anchor Line, ship-type lamps.

The Bradford Rotary Converter Contract.—At the meeting of the Bradford City Council, on March 11th, according to the *Leeds Mercury*, Mr. G. R. Carter objected to a proposal of the Electricity Committee to give an order for a rotary converter to a Belgian firm. At present, he said, twenty per cent. of the insurable workmen in the Amalgamated Engineers' Union were unemployed, and there were at least 40,000 craftsmen in his Union (the A.E.U.) without work. It had been stated that by sending the contract abroad they were saving £4,000. He had gone into details, and found that the contract, if it had been placed in England, would have provided 100 workmen with work for six months, and £6,500 in pay. Instead of that, these men would probably be receiving unemployment pay or poor law relief, so that the Bradford ratepayers would probably have to pay, as taxpayers more than the £4,000. In fact, he thought that it would cost at least £10,000 to the ratepayers. Alderman W. Turner, chairman of the Electricity Committee, said they had done all they could to keep the contract at home, but the Belgian make of machine just happened to fit their building, besides being cheaper.

Social Events.—The last Siemens staff social of the season was held at 38-39, Upper Thames Street, E.C., last Friday evening. A very enjoyable concert commenced the proceedings, and, in addition to a number of variety turns, two sketches were successfully produced. A dance followed the concert, and the evening was a great success.

On March 6th about 500 members and friends of the Elliott Staff Association (Messrs. Elliott Bros. (London), Ltd.) gathered at the Borough Hall, Greenwich, on the occasion of their annual social and concert. An excellent programme was presented, music being provided by the Century Works Orchestra.

Unemployment.—The registers of the employment exchanges recorded a total of 1,101,200 unemployed persons on March 3rd, a decrease of 18,750 during the week. On the other hand, the number of "part-time" workers increased from 47,830 to 53,000. The reduction in the number of unemployed since the beginning of the year has been 148,910.

Tramway Employés' Wages.—The claim of the employés of the London County Council Tramways and other London tramway undertakings for a general increase of 8s. per week has been the subject of conferences and discussions during the past week or so. The employers have stated that the increase could not possibly be conceded without an increase in fares. The Transport and General Workers' Union, of which the men (numbering about 17,000) are members has promised that no strike action will be taken without due warning to the public.

On Saturday last the Ministry of Labour definitely intervened in the dispute, and a conference was held on Monday last between the Minister of Labour and the employers. On the following day the Minister met representatives of the men's union.

The omnibus employés have promised to support the tramwaymen in the event of a strike.

The Highways Committee of the L.C.C. has agreed with the Transport and General Workers' Union, with regard to "spread-over" duties, that:—Straight-through duties of tramwaymen shall represent not less than 60 per cent. of the whole duties at each depôt; that a payment of 1s. shall be made in respect of duties exceeding 10½ hours; that no increase shall be made in the present proportion of spread-over duties exceeding 12 hours at each depôt; and that, so far as can be arranged, all duties starting before 6.20 a.m. shall be worked straight through. The estimated cost of these concessions is £20,000 per annum.

Halifax and the Staff J.I.C.—The Corporation Electricity Committee has decided not to rejoin the Joint Industrial Council of Employers and Staff Members of Electricity Undertakings, with which it severed its connection a year ago on the occasion of the lock-out of station engineers, which resulted in the Halifax stations being filled with entirely new staffs.

The Greek Market for Electrical Goods.—According to a report by the United States Consul at Athens, the market for electric lamps is monopolised by the so-called "European trust" of electric lamp manufacturers. Germany and Italy are the principal suppliers. Switchgear to the amount of 14,475 kg. was imported during 1922; in the previous year the figure was 48,252 kg. Germany supplied the bulk of this, and other materials, for instance, rubber- and cotton-insulated wires and porcelain articles. Iron and bronze telegraph wire imports amounted to 898,000 kg., of which 637,108 kg. came from Belgium. Imports of dynamos and motors totalled 233,740 kg., of which Germany supplied 117,207 kg., Austria 53,556 kg., and the United States 21,000 kg. Dynamos are generally of from 25 to 50 kW, d.c., 110 V, and motors vary from 1 to 12 h.p. Great Britain's share in machinery exports fell from 1,326 metric tons in 1921 to 668 metric tons in 1922.

A French Amalgamation.—M. E. Vedovelli informs us that the Compagnie Générale Electrique, of Paris, has amalgamated with L'Appareillage Vedovelli. The former has made a speciality of "asynchronous synchronised" machines which can be used as motors with a power factor nearly unity, as generators which can be paralleled without synchronising, or as rotary condensers, and the latter firm is well-known for its high-pressure switchgear and equipment, claiming to have demonstrated for the first time on the Continent the transmission of power at 100,000 volts, at the Turin Exposition of 1911.

Export Trade to Japan.—At the monthly luncheon of the National Union of Manufacturers Inc., held at the Holborn Restaurant, Sir Edward Crowe, who has recently returned from Japan, where he was Commercial Attaché, and is now acting as Director of the Foreign Division of the Department of Overseas Trade in London, delivered an address on Japan. He dwelt upon various points which are of urgent importance to British exporting traders and manufacturers, stressing the keenness of United States competition and the necessity for our firms to increase their activity in the market. A point that must not be overlooked, however, is the effect of the recent earthquakes upon the stability of business houses which before those disasters were strong but are now financially weak. This suggests the need for making full inquiries regarding such matters before opening up new accounts. No doubt Sir Edward, through his department, will be able to assist those in need of information.

Neuhausen Aluminium Industry.—The report of the Aluminium Industrie, A.G., of Neuhausen, states that despite manifold difficulties it was possible to increase the production in 1923 to a satisfactory level, although all the works were unable to utilise their productive possibilities fully. As from the middle of last year the company succeeded in keeping selling prices on a level, which corresponded better than for two years previously to the higher costs of production brought about through the war. The increases in the prices of raw materials which were foreseen in 1922 resulted in an advance in the costs of production to an extent which corresponded approximately to the general growth in costs prevailing since the end of the war. It did not seem that it would be possible to reduce the costs of production within a measurable period, but, rather, that a further increase must be reckoned with as the additional financial burdens were considerable, particularly the State burdens. To-day the sales activity extends to all essential markets, and the connection with the aluminium working-up industry has opened up new possibilities of business. It has been possible for the company to adapt itself to the completely changed situation of the aluminium market since 1918, and full compensation for lost markets has been obtained through the sales organisation. The rate of dividend is 12 per cent. out of net profits of 8,038,000 fr., as compared with 9 per cent. and 4,242,000 fr. in 1922.

Russian Industrial Notes.—*Large Transformers.*—The Kharkoff works of the Central Electrical Trust (the former V.E.K. works) is reported to have recently produced transformers of 4,000 kVA and a pressure of 33,000 volts. It has now received orders from the Baku Oil Trust for the delivery of transformers of 10,000 kVA and a pressure of 41,000 volts.

It is only very recently that the Government electro-mechanical factory, of Kharkoff, has successfully overcome the difficulties involved in the production of high-voltage transformers with their necessary insulation, for which purpose the concern named installed a complete special plant, including three vats of 350 poods capacity each, for preparing and heating the oil. The oil is cleaned and passed from one vat to the other by a special filter and pump. The transformer is put into a special vat and heated; then covered with what is said to be oil which, under high pressure, enters all the pores; the operation takes no more than 20 hours, whereas foreign methods require over a hundred hours. The fact that the transformers were made in Russia should be noted, says the report quoted, because "we trust our own power too little, and repose too much confidence in the West." The order for these two 4,000-kVA transformers was difficult to get; that for oil separators went abroad, where the order for the transformers was to have gone, but finally it was given to the factory above named, and the success reported has prompted the Asnepht to give an order for transformers of still greater capacity, as stated above, to the same factory. The completed transformers are made entirely of Russian material; only the presspahn is foreign. The successful production of the finished transformers is described as a great victory for Russian technique.

Cost of Production and Selling Prices.—Two recent meetings of the industrial section of the State Planning Commission were devoted to an examination of the productive programme of the electrical manufacturing industry for the current financial year. As was mentioned a short time ago, the financial programme estimates an excess of expenditure over income in the case of all the manufacturing undertakings amounting to 2,453,000 trading roubles, but the cash deficit is computed at 670,000 trading roubles for the year. According to information placed before the section by the General Electrical Commission, the works cost of production in trading roubles does not materially differ as compared with the pre-war period. In different branches of production the costs are as follows: In the cable branch the costs of production are from 95 to 105 per cent. of the pre-war costs; in the electric machine branch the costs of production have advanced by 87 per cent. over the figures for 1913; and in the lamp industry the costs are 96 per cent. of the pre-war level, a reduction of 4 per cent. The 1913 output of lamps was not on the same high level as it is at the present time. But if the works costs have not particularly risen in the period under consideration, the co-efficient of increase in the selling prices of electrical manufactures is considerably higher. The overhead expenses are said to be undoubtedly large, and form about 20 per cent. of the costs of production. The industrial section has reached the conclusion that the comparatively small load on the works, as contrasted with their productive capacity, prevented the costs of production from being lowered, and at the same time the opinion was expressed that sale prices ought to be reduced, particularly for lamps and conductors, especially as the works concerned with these products are working under favourable conditions, whereas the machine works are being operated at a loss.

British Trade-Mark Applications.—The following are among the recent applications for British trade marks. Objections may be entered against any of the proposed marks within one month from the dates mentioned:—

Southalite. No. 443,685. Class 50.—Electric insulators and electric insulating materials. The Siluminite Insulator Co., Ltd., 16, Dowgate Hill, London, E.C. March 5th, 1924.

Valcrys. No. 444,768. Class 8.—Wireless and other telegraphic and telephonic apparatus. The Cable Accessories Co., Ltd., Britannia Works, Groveland Road, Tividale, Tipton, Staffs. March 5th, 1924.

Electroflo. No. 444,505. Class 8.—Apparatus for the electrical measurement of the flow and pressure of gases and vapours. Burton Dunghman, 109, Kingsway, London, W.C. March 5th, 1924.

Nordite. No. 444,352. Class 8.—Detector crystals for wireless telephonic apparatus. Alfred Gould, 45, Fountayne Road, Stoke Newington, London, N. March 5th, 1924.

Midite. No. 444,353. Class 8.—Detector crystals for wireless telephonic apparatus. Alfred Gould, as above. March 5th, 1924.

Wallnut. No. 443,536. Class 8.—Instruments and apparatus for use in wireless telegraphy. Arthur G. London, "Melrose," Smitham Bottom Lane, Purley, Surrey. March 5th, 1924.

Terradio. No. 444,004. Class 8.—Earth mats for use with wireless telephonic sets. Wallis Newton, 13, Rochdale Road, Blackley, Manchester. March 5th, 1924.

Radiobrix. No. 440,717. Class 8.—Instruments and apparatus for use in wireless telephony and telegraphy, Metropolitan-Vickers Electrical Co., Ltd., 4, Central Buildings, Westminster, S.W. March 5th, 1924.

Hearthside. No. 443,751. Class 8.—Instruments and apparatus for use in wireless signalling. General Radio Co., Ltd., Twyford Abbey Works, Acton Lane, Harlesden, N.W.10. March 12th, 1924.

Mic-Met. No. 442,473. Class 8.—Wireless telephonic receiving apparatus. Cox & C. & J. Arrigoni, 8, Compton Passage, Compton Street, London, E.C.1. March 12th, 1924.

Mellovox. No. 444,939. Class 8.—Loud speakers. Sterling Telephone & Electric Co., Ltd., London, W. March 12th, 1924.

Fanovox. No. 444,938. Class 8.—Loud speakers.—Sterling Telephone & Electric Co., Ltd., London, W. March 12th, 1924.

Simplex. No. 440,029. Class 8.—Fitted electric switchboards, electric cables, batteries (not for medical purposes), electrical instruments, &c. No. 440,030. Class 13.—Electrical metal goods, including electric light fittings and accessories, switches, &c. No. 440,031. Class 16.—Electric insulators and electric insulating material of pottery and earthenware. No. 440,032. Class 18.—Electric wiring systems, electric alarms and bells, &c. No. 440,033. Class 50.—Electric insulators and electric insulating substances, all composed of synthetic materials, &c. Simplex Conduits, Ltd., Birmingham. March 12th, 1924.

Ra-Diag. No. 444,211. Class 8.—Apparatus for wireless telephony and telegraphy. William S. Wilson, trading as W. Samuel Wilson, 167, Evering Road, Stoke Newington, London, N.16. March 12th, 1924.

Raydo. No. 444,425. Class 8.—Thermionic valves. Bale and Hardy (London), Ltd., 47, Victoria Street, London, S.W.1. March 12th, 1924.

C.E.S. Co., Ltd. (lettering and design). No. 444,756. Class 8.—Electric accumulators, not for medical purposes. The Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester. March 12th, 1924.

A Design Combining Letters A and C. No. 442,632. Class 13.—Electric contacts and terminals. Cece Graphitwerke Gesellschaft, Affoltern, near Zurich, Switzerland (S. Sokal, 1, Great James Street, Bedford Row, London, W.C.1). March 12th, 1924.

British Empire Exhibition Notes.—It is announced that the King is to open the Exhibition in person, and that the opening will be a full ceremonial occasion. While it is not possible definitely to announce the opening date, it is hoped that it will be possible to adhere to the promised day—April 23rd.

The strike of electricians employed at the Exhibition, which was to have taken place on Saturday last, was again postponed following upon a decision to communicate with the Amalgamated Engineering Union and the Building Trades Federation with regard to the wages of the men who are members of those unions and are employed on electrical work at lower rates than the standard rates for electricians. The E.T.U. requires the support of these unions in the event of a strike.

The Leipzig Fair.—A correspondent of *The Times* says that the Leipzig Fair has been visited by an exceedingly large number of people, though the proportion of Germans to foreigners is stated to be higher than at any fair since the war. From reliable reports it seems that the value of trade done is below the average and that there is noticeably a falling off in orders for abroad. The general conclusion is that the prices are too high. This may be due to the more advantageous prices now offering in France and Belgium, in view of the exchange. The prices are not considered so high by the buyer for the home market. The conditions at Leipzig afford some indication of the position in Germany generally. They confirm the impression that there has been a great shrinkage of trade, and that, owing to credit shortage and the high rate of interest, there is no sign of an early expansion.

Lighting and Power Notes.

Accrington.—NEW PLANT.—The Town Council has approved of extensions to plant at the electricity works at an estimated cost of £50,000.

Australia.—TOOWONG (QUEENSLAND).—The electricity supply for Toowong was officially inaugurated on January 16th. A bulk supply is obtained from the Brisbane City Electric Light Co.

CAMPBELLTOWN (N.S.W.).—On January 23rd the electricity supply for the town was formally switched on. The cost of the scheme was £10,000.

Bletchley. — ELECTRICITY SUPPLY. — The Urban District Council has decided to lodge an objection to the electricity scheme of the Northampton Electric Light & Power Co., Ltd., and to support the scheme of Luton Corporation.

Bolton.—LOAN.—The Corporation is applying for sanction to the borrowing of £185,643, which includes £50,000 for mains.

Bradford.—NEW SUB-STATION.—The new sub-station in Bolton Road, the building of which has cost £150,000, was inaugurated on March 13th.

Bridge of Allan.—ELECTRICITY ORDER.—The Town Council has applied to the Electricity Commissioners for an Order authorising it to distribute electricity in the borough. It is proposed to obtain a supply from the Scottish Central Electric Power Co., which has recently erected a sub-station in the town.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The Premier, Mr. P. J. Weniot, has announced that the Government intends to undertake the hydro-electric development of the Grand Falls on the St. John River, near the Maine border, where from 60,000 to 80,000 h.p. is available.—*Reuter* (Fredericton, N.B.).

Chesterfield.—LOAN.—The Corporation is applying to the Electricity Commissioners for sanction to the borrowing of £10,000 for plant and mains.

Colchester.—NEW PLANT.—With reference to the proposed new generating station, the Electricity Commissioners have informed the Town Council that they are not prepared to approve the transfer of plant from the present station to the proposed new one, and that the plant to be installed is to consist of two 1,250-kW sets and one 2,000-kW set.

Continental.—CZECHO-SLOVAKIA.—On February 18th the linking-up of the municipal power station at Gablonz with the 35,000-V transmission line was inaugurated, whereby, on one side, connection was established with Tannwald, Königgrätz, Trautenau, Pardubitz, and as far as Prague, and on the other side with Engelsberg and thence over Hirschberg to Berlin, Dresden, and the Baltic, and through Leipzig to Nuremberg and beyond to the frontier of the Tyrol.

AUSTRIA.—The important scheme for the harnessing of the Achensee (Lake Achen) and the erection of a power station in the city of Innsbruck is progressing, and it has been decided to form a company styled the Tiroler Wasserkraft Aktien Gesellschaft, with a capital of 15,000,000 gold crowns, which the Bodenkredit Anstalt group will advance, to carry out the constructive operations. A beginning is to be made immediately, and by the spring of 1927 portions of the joint undertakings are expected to be completed. Electrical energy will be supplied to the city of Innsbruck, and a number of towns and industrial districts in the North Tyrol.

SARDINIA.—According to the *Manchester Guardian Commercial*, a large reservoir is under construction in Sardinia. It is intended for supplying water for agricultural purposes during the dry season and for generating electrical energy. The power stations at present comprise two sets each of 6,000 h.p. and two sets each of 9,000 h.p. The sets are operated at an average head of 46 metres and are to supply 50 million kWh. Electrical energy will be distributed throughout Sardinia by a network controlled by a local company at pressures of 75,000 to 150,000 V. When the scheme is completed, a total of 400 million kWh will be available. This will partly be used for operating on a larger scale than heretofore the ore mines of the island.

Cornforth.—ELECTRICITY SCHEME.—A sub-committee appointed by the local Council to consider the question of an electricity supply for the district has been in negotiation with the County of Durham Electric Power Distribution Co. The company has now submitted a scheme for lighting Old Cornforth and West Cornforth, the electricity to be supplied from the power station at Coxhoe. The Council has approved the scheme, and has decided to obtain estimates as to the cost and to apply to the Electricity Commissioners for sanction to a loan.

Dewsbury.—ELECTRICITY AGREEMENT.—The Town Council has confirmed an agreement with the Yorkshire Electric Power Co., extending over a period of 42 years, for the supply of electricity to Earlsheaton.

Dundee.—OPPOSITION TO ORDER WITHDRAWN.—The Parliamentary Bills Committee of the Town Council has recommended that opposition to the Grampian Electricity Supply (Provisional) Order be withdrawn. Representatives of the promoters have promised to insert a clause granting the Council the protection given under the original Bill of 1922.

Dunoon.—ELECTRICITY SUPPLY.—A scheme for the lighting of the town by electricity supplied from the Greenock Corporation station, by means of a cable across the Firth, is being discussed, and it is understood that Dunoon will guarantee the interest and sinking fund charges and that the agreement will be for 21 years. The estimated cost of the scheme is £10,000.

Faversham.—BULK SUPPLY.—In connection with the proposal to obtain a bulk supply of electricity during the winter of 1924-25 from Canterbury Corporation, the Town Council has received a notice from that authority stating that it is not in a position to give such a supply by the time mentioned, but if necessary the Corporation would consider the question of a supply for the winter of 1925-26.

Gateshead-on-Tyne.—WIRING OF SMALL HOUSES.—At a meeting of the Town Council on March 5th, the Housing Committee recommended that the County of Durham Electrical Power Distribution Co.'s offer for the electrical equipment of the 104 houses to be erected on the Carr Hill estate be accepted. The total estimated extra cost of substituting an electric system for gas is £857. The tariff proposed to be charged by the company to consumers for lighting, heating, and cooking is:—Five-roomed house: Fixed charge of 4s. 6d. per month and 1d. per kWh up to 2,040 kWh per annum, and ¼d. per kWh for all energy in excess of that quantity. Four-roomed house: Fixed charge of 4s. per month. Three-roomed houses: 3s. 6d. per month; the "unit" charges to be the same as for five-roomed houses. The apparatus in each house would consist of a washer, a boiler, radiators, fires, and cooking stoves. The Committee's proposal was adopted.

Gillingham (Kent).—LOAN.—The Town Council has applied to the Electricity Commissioners for sanction to a loan of £21,635 for the provision of two 330-kW Diesel engines with alternators, switchboard, water tank, and cooling tower.

Irish Free State.—LIFFEY POWER SCHEME.—The Rathmines (Dublin) Urban District Council has decided to oppose the Dublin Electricity Supply Bill, the East Leinster Electricity Supply Bill, and the Irish Hydro and Peat Electric Power Bill. Col. Claude Cain, Celbridge, has protested against portions of the schemes for harnessing the River Liffey, on the grounds of danger to the salmon fisheries and destruction of scenic beauty at the Salmon Leap, Leixlip, Co. Kildare.

HOWTH (Co. DUBLIN).—The electric lighting scheme for the district is now well advanced, and will be completed in a few weeks. Electrical energy will be obtained from the Great Northern Railway (Ireland) Works at Sutton.

Kirkcaldy.—NEW PLANT.—The Electricity Committee has recommended to the Town Council that application be made to the Electricity Commissioners for sanction to install a new 1,500-kW rotary converter at the electricity works at an estimated cost of £11,225.

Liverpool.—STREET LIGHTING.—The Electric Power and Lighting Committee is abolishing the "middle-of-the-road" electric standards. Side standards or lamps suspended from overhead wires are being substituted.

London.—FULHAM.—The Electricity Committee has recommended that a special rate for electricity supplied for shop-window lighting after business hours and for illuminated electric signs be adopted. The charge for such supplies after 7 p.m. will be at the same rate as for power supplies, plus 50 per cent., with a meter charge of 12s. 6d. for the winter quarters. No meter charge will be made for the summer quarters.

ST. MARYLEBONE.—The Electricity Committee has recommended to the Borough Council that, subject to the consent of the Electricity Commissioners, an agreement be entered into with the Central Electric Supply Co., Ltd., to provide for a connecting link with the company's undertaking and for the Council taking a supply of electricity as from the December quarter, 1925, for a period of six years, commencing with a maximum demand for 5,000 kW, to be increased within the two or three following years to, say, 10,000 kW, the price to be paid by the Council to be the actual cost price to the company, including capital and running charges to be determined at the end of each year.

Normanton.—LOAN SANCTIONED.—The Urban District Council has received the sanction of the Electricity Commissioners to a loan of £2,000 for mains.

Northern Ireland.—PORTSTEWART (Co. ANTRIM).—The Urban District Council has applied to the Northern Ireland Electricity Commissioners for an Order authorising it to purchase the electric lighting undertaking from the local committee at a cost of about £2,500.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

DONCASTER.—Lighting: From 6½d. to 6d. per kWh. Heating and cooking: From 2d. to 1d. per kWh.

HALIFAX.—Lighting: Over 12,000 kWh per quarter, from 3½d. to 2d. Shop lighting &c.: 7d. per kWh for the first 200 hours' use of maximum demand per half-year, and 1½d. per kWh for all energy in excess of this amount. Heating and cooking and tramway supplies: From 1½d. to 1¼d. per kWh.

Windsor.—*The Windsor Electrical Installation Co., Ltd.*—Lighting: a reduction of 1d. per kWh.

Canterbury.—Lighting: Varying from 7d. per kWh for the first 250 kWh per quarter down to 5d. per kWh for over 20,000 kWh. Power and heating: Varying from 2½d. per kWh for the first 500 kWh per quarter down to 1½d. per kWh for over 7,500 kWh.

Hastings.—Lighting: From 6½d. to 6d. per kWh.

Aylesbury.—Supply to private dwellings: A charge of 8d. per kWh for an initial consumption according to the rateable value, and thereafter 1½d. per kWh. Slot meters: 9d. per kWh. Power: First 500 kWh per quarter, 3½d. per kWh, next 500 kWh, 2½d.; all energy in excess of 1,000 kWh, 2d. per kWh.

Newport.—Lighting: From 6½d. to 6½d. per kWh.

Scarborough.—*The Scarborough Electric Supply Co., Ltd.*—Lighting: From 1s. to 11d. per kWh.

Sheffield.—Linking-up.—The Electricity Committee has recommended that the Corporation's seal be affixed to an agreement with the Rotherham Corporation with reference to the linking up of its power station with the Sheffield Blackburn Meadows station, and that the general manager be authorised to proceed with the work.

Electricity Extensions.—The Electricity Committee has approved extensions of mains at an estimated cost of £14,683, and extensions and works for general distribution purposes at an estimated cost of £26,363.

Southampton.—Electricity Supply.—The Harbour Board is to consult an expert with reference to the advisability of the Board installing its own electricity plant.

Stafford.—Loan.—The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of £4,500 for mains.

Stanley (Co. Durham).—Electricity Supply.—At a special meeting of the Urban District Council on March 12th, unanimous approval was given to the recommendations of the General Purposes Committee that the Council should proceed with the electric lighting of the district, the Council to be the distributing authority, and take steps for obtaining the necessary Order. It has been decided to obtain the services of an electrical expert to advise on the scheme.

Stockport.—Proposed New Plant.—The electrical engineer (Mr. R. Lomax) has submitted a report to the Town Council on proposed extensions to the electricity undertaking. Among the additions suggested are the installation as necessity arises of three 12,000-kW sets to replace d.c. turbines, an increase in the number of boilers, and the installation of cooling towers for additional water supply. The estimated cost of the additional plant and alterations is £232,000. The Town Council is to obtain the advice of a consulting engineer on the scheme.

Sunderland.—Sub-stations.—The Corporation has decided to proceed with the following works:—Changing over the system of supply in the Roker area from direct to alternating current, including the provision and equipment of an outdoor sub-station, at an estimated cost of £2,381; the equipment of a static sub-station to be temporarily housed in the old boiler house at the Dunning Street sub-station, and the laying of 4,000 yd. of l.p., a.c. cable in the central area of the borough, at an estimated cost of £9,134; the erection of a sub-station for the development of the Durham Road area, also the laying of 4,150 yd. of a.c. cable and 2,540 yd. of one-way earthenware duct, at an estimated cost of £10,844. The expenditure of £12,697 will be met out of revenue, and application is to be made to the Electricity Commissioners for sanction to the borrowing of the remaining amount, and to the Unemployment Grants Committee for a grant towards the cost of carrying out the work.

Swadlincote.—Electricity Supply.—The Urban District Council has consented to the application of the Burton-on-Trent Town Council for a Special Order authorising the Corporation to supply electricity to the district subject to the maximum charge for electricity for lighting being 1d. per kWh above, and for power 15 per cent. above the charges at Burton, and that the Council has the option of purchasing so much of the undertaking as is within the Urban area after the expiration of seven years, and at every subsequent period of seven years.

Tunbridge Wells.—Extension of Mains.—The Electricity Committee has agreed to an extension of the mains to the village of Penshurst at an estimated cost of £2,000.

United States.—Electricity Schemes.—According to the *Electrical World*, the Sioux City Gas & Electric Co. is to erect a large generating station on the Big Sioux River. The equipment will include two 11,250-kW sets, and the station will have an ultimate capacity of at least 90,000 h.p. The electrical energy will be generated at 13,000 V and raised to 33,000 V for transmission to Sioux City and other districts within a radius of 100 miles. The estimated cost of the scheme is $3,500,000.

The House of Representatives has approved the offer of Mr. H. Ford to take over the Muscle Shoals power station, which was commenced by the Government during the war.

Whitworth (Lancs.).—Loan Sanctioned.—The Urban District Council has received the sanction of the Electricity Commissioners to the borrowing of £8,600 for the following purposes:—Mains and services, £7,500; plant, £1,000; meters, £100.

Tramway and Railway Notes.

Ayr.—Railless Cars.—The Tramways Committee is to consider a proposal to run railless cars.

Blackburn.—New Cars.—The Town Council has decided to purchase a "one-man" car and an additional covered car for experimental purposes.

Continental. — Czecho-Slovakia.—The construction of a railway to open up the tourist district of the Riesengeberge was the subject of a meeting at Arnau on February 14th. The line is planned to run from Arnau to Schwarzenthal, and the surveys have already been made as far as Forstbad.

Sweden.—A scheme has been proposed by Mr. Julius Korner, civil engineer, which aims at the electrification of the private railways in Central Sweden. The engineer has asked the State Waterfalls Administration to provide a sum of 4,500 kroner so as to permit of an examination of the problem being made, and the Administration has recommended the Government to sanction the request. Representatives of the private railways and power stations have decided to contribute a sum of 7,500 kr. towards the cost of the investigation.

Spain.—The Compañia del Ferrocarril de Sarria a Barcelona has applied for a concession to construct a secondary underground railway in Barcelona in connection with its line above named.

Bradford.—Electric Signalling Apparatus.—The London and North-Eastern Railway Co. (Great Northern Section) has introduced electric railway signalling equipment in the Lisasterdyke and Dudley Hill station areas in the Bradford district. The system is to be extended shortly to St. Dunstan's (Bradford) and to Bramley.

Light Railways.—The Minister of Transport has recently made the following Orders:—The Southport Corporation Light Railways Order, 1924; the North Devon and Cornwall Junction Light Railway (Extension of Time) Order, 1924.

London.—Work will shortly be put in hand in connection with the new Kennington loop, which will connect the Hampstead Tube with the City and South London Railway. When this section is completed a direct route from South-West London to the West End will be established.

Southwark Bridge Tramways.—The City Corporation has consented to the construction of tramways over Southwark Bridge, providing that certain conditions are inserted in the L.C.C.'s Bill. Among the conditions are the following:—(1) The site of the terminus to be determined by the Corporation; (2) the licence to run the cars to be limited to 21 years; (3) that no shelters be erected.

Plymouth.—Track Renewals.—In a report on the tramways, submitted to the Corporation by the general manager (Mr. H. P. Stokes), the following recommendations are made:—That seven schemes of tramway track reconstruction be carried out in 1924-25 at a cost of £31,312, and four schemes in 1925-26 at a cost of £31,431, for which a loan shall be raised, and two schemes in 1926-27 at a cost of £19,209 to be provided for out of the reserve. Further schemes from 1927 to 1931, amounting to over £30,000 are detailed, which it is also proposed shall be borne by the reserve fund.

Sheffield.—Reduced Tramway Fares.—The City Council has reduced the return fare on the Walkley and Nether Edge tramway routes from 3d. to 2½d., and on the Woodseats section the penny fare stage has been extended.

Southport.—Accident.—An electric train on the suburban service between Southport and Crossens left the rails on Monday night, March 10th, outside Southport station. Five passengers were slightly injured.

Telegraph and Telephone Notes.

France.—Proposed South American Cable.—A *Reuter* message from Montevideo announces that the Government has refused to extend for four years longer the period allowed for the laying of the new cable between France and South America.

Telephone Service.—The Paris Chamber of Commerce has passed a resolution urging the Government to introduce immediately a Bill in the Chambers for the transference of the telephone service to private French companies.—*Reuter's Trade Service* (Paris).

Guernsey.—Telephone Service.—For the year ended December 31st, 1923, the Guernsey States telephone undertaking made a net profit of £430, the total revenue being £14,908, which figures show increases of £12 and £1,227 respectively on the previous year's results. The mileage of overhead circuit wire increased by 54¾ miles to 2,230¾ miles, and that of the underground circuits by 417¼ miles to 2,696 miles. The total number of lines of all kinds increased by 209 to 3,269, while the total number of calls increased by 236,938 to 1,958,301, and the junction calls to and from Sark increased by 1,609 to 11,102; the number of telegrams and express and other letters telephoned to the Post Office grew by 380 to

18,543, and the number of employés (including Mr. E. H. Bennett, engineer and manager) increased by 5 to a total of 80.

Radio at Sea.—AUTOMATIC CALL DEVICES.—That the S.O.S. call from ships in distress should be recorded automatically, it has been argued, is of the utmost importance from the point of view of safety of life at sea. On big ships it is possible to maintain a continuous "watch," but, in the case of small vessels having little or no radio traffic, the provision of *personnel* for this purpose is a serious expense to ship-owners. For the past two years engineers of the G.P.O. and various radio companies have been making a special effort to solve this difficult problem by means of a call device which will respond automatically to the distress or alarm signal, and both the Admiralty and the shipping companies are equally keen to secure satisfactory apparatus capable of standardisation. The Chamber of Shipping recently arranged for the s.s. *Rathlin* to carry out trials of automatic call devices, and three sets were tested—those of the G.P.O., the Marconi Co., and the Radio Communication Co. An interim report has been issued by the Admiralty on the results of the first series of tests, and it is reported that, while the G.P.O. set was the most sensitive at the longer ranges, by far the greatest number of correct calls was obtained by the apparatus of the Radio Communication Co.

The Telephone Service.—NEW AUTOMATIC EXCHANGES.—The Postmaster-General announces that two automatic telephone exchanges were opened in the Dundee area on March 14th, one in Dundee and one in Broughty Ferry, to take the place of manual equipment which has been in use for many years.—*The Times.*

"MULTI-COIN" CALL BOXES.—A new coin box is making its appearance in London telephone boxes. It has been installed at the Charing Cross, Covent Garden, and Church Place, Piccadilly, post offices. With the coming of the "toll" exchanges, a need has arisen for a coin box that will take sixpences and shillings, as well as pennies, and by an ingenious arrangement of gongs and bells, the operator at the telephone exchange is able to tell what kind of coin is being inserted in the box. If the call is not completed, the money is returned by depressing a button in the coin box.—*Daily Mail.*

Radio Notes.

London's Broadcasting Station.—SUGGESTED NEW SITE.—It is understood that a new broadcasting station, to have a power of 3 kW, may be erected by the B.B.C. on the top of a well-known London stores, steel towers, 150 ft. high and 150 ft. apart, being erected to carry the aerial. The transmitting plant at Marconi House will, it is suggested, continue to function for a time after the new station is built, so that two independent programmes on different wave lengths may be broadcast.

Loud-Speaker Demonstrations.—G.E.C. SCHEME.—The proposed broadcast speech on the British Empire Exhibition by the Prince of Wales from the London and other stations simultaneously has led to an enterprising effort by the General Electric Co., Ltd. The extensive "Gecophone" Service Depôt organisation is co-operating in arranging Gecophone demonstrations, to which the public are invited, in many towns and districts throughout Great Britain, so that people in all parts of the country will be able to "listen." In addition, arrangements have been made with a large number of the leading London and provincial kinemas for the speech to be broadcast by Gecophone equipment during an interval in their performance on the night in question. Similarly, the Haymarket Theatre in London will also broadcast the speech to its audience, whilst the G.E.C. at its head office and all provincial branches will do likewise. Owing to his recent accident, the Prince was obliged to postpone the delivery of the speech.

New Detector Valve.—FILAMENTLESS TYPE.—Writing in the *Daily Mail*, "Ariel" states that he has been carrying out experiments with colloidal solution "filamentless" valves, and considers that there is every indication that, although they may never displace ordinary valves in amplifying capacities, it is possible that a new and very efficient detector will be developed on those lines. He used an ordinary glass tumbler half-filled with distilled water. To this half a teaspoonful of 8 per cent collargol solution, which is a preparation of colloidal silver, is added. If two small platinum plates are suspended in this solution by means of platinum wires, an extremely efficient detector results, which can be introduced into any ordinary circuit. A platinum wire can be interposed to act as a grid if desired. The solution rapidly deteriorates unless it is kept airtight.

New Stations.—CALL SIGNALS.—When the Belfast (North Ireland) broadcasting station is opened it will have a wavelength of 435 metres and the call signal of 2 BE.

The relay station at Rawdon, Leeds, which is to be opened in May, will have the call signal of 2 LS, and its power will be ½ kW.

United States.—BROADCASTERS' STRIKE.—According to the daily Press, a strike is threatened in the United States as the result of numerous obstacles placed in the way of broadcasters. The threat is the result partly of suits for alleged infringement of patent rights brought against several companies engaged in broadcasting, and partly of the demand made by publishers for royalties on all copyright music used in wireless concerts. Broadcasters declare that, owing to this attitude, they are unable to vary their programmes sufficiently, and they argue that the only way to arouse public opinion in favour of the clarification by the Government of the broadcasting situation is to organise a temporary cessation of broadcasting.

Mr. Herbert Hoover, Secretary of Commerce, states that the American Government will never allow broadcasting to become monopolised. This statement was made on the issue raised by the Radio Corporation of America and other companies which complained that stations were using their devices without having secured a licence to do so.

NEW YORK MUNICIPAL STATION.—New York City has arranged to install a 1,000-watt broadcasting station on top of the Municipal Building. The plant will be owned and operated by the municipality and be used to broadcast events in which the city is concerned. The set to be used is that which the Westinghouse Electric & Manufacturing Co. built for demonstration purposes at the Rio de Janeiro Exhibition in 1922. While in use there its messages were heard at Honolulu, 7,000 miles distant.—*The Times.*

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Argentina.—BUENOS AIRES.—April 23rd. Sanitary Works Department. Electrically-driven centrifugal pumps. Ref. 6,084/25/FL/EC2 (a).*

April 24th. Machinery and materials for the electric power station at Conception del Uruguay.

Australia.—SYDNEY.—March 27th. Postmaster-General's Department. Signal cable and insulated wire. (Schedule N.S.W. No. 69).*

BRISBANE.—April 9th. Brisbane Tramway Trust. Fifty 50-h.p., 500-V, d.c. traction motors; 30 ditto, 60 h.p., or, alternatively, 80 60-h.p., 550-V, d.c. traction motors, with 15 sets of control equipment and spare parts.

PERTH.—April 23rd. Postmaster-General's Department. Accumulators.*

Belfast.—April 7th. Electricity Department. Three-phase e.h.p. a.c. switchgear; three-phase h.p. a.c. switchgear. (March 14th.)

Belgium.—The Belgian State Railway authorities in Brussels have this week invited tenders for the supply of 30 kilometres of specially-insulated bronze wire and 80 kilometres of insulated copper wire.

March 26th. The Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. Six lots of bronze wire. Particulars (Cahier des Charges Special No. 33) for 2½ fr.

March 28th. Municipal authorities of Zonhoven (Province of Limbourg). Establishment of a low-pressure electricity distribution system in the town. Particulars for 15 fr.

April 3rd. Municipal authorities of Montenaeken (Province of Liége). Establishment of a low-pressure electricity distribution system in the town. Particulars for 40 fr.

Dearne.—March 24th. Electricity supply: Electric cables; sub-station switchgear; electricity meters; three-phase transformers. (March 7th.)

Eccles.—March 24th. Electricity Department. Cables required during 12 months:—H.p. and e.h.p. paper-insulated cables, l.p. bitumenised fibre-insulated cables; joint boxes. Borough electrical engineer, Electricity Works, Cawdor Street, Patricroft.

Edinburgh.—March 31st. Midlothian and Peebles District Asylum. Stores, including electrical fittings, for six months. Clerk, 19, Heriot Row, Edinburgh.

Egypt.—CAIRO.—May 31st. Egyptian Ministry of the Interior. Pumping plant, &c., for Mehalla el Kobra. Electric motors and accessories, pumps and accessories, cables, filters, including alum distributing apparatus, switchboards, tools and plant.*

Glasgow.—March 24th. Public Works Department. Electrical work at Public Hall at Tollcross. Office of Public Works, City Chambers.

Kettering.—March 24th. Electricity Department. Two l.p. armoured lead-covered feeder cables. Two feeder pillars. (March 7th.)

Littleborough.—March 22nd. Electric lighting installation, Littleborough Reform Club, Littleborough. Particulars from secretary.

London.—Metropolitan Water Board.—April 23rd. Two 25-kW steam-driven electric generators, switchboard, piping, &c., at Littleton pumping station; and one 150-kW steam-driven electric generator, switchboard, piping, &c., at Walton pumping station. (March 7th.)

Lyme Regis.—April 4th. Town Council. Reorganisation of the electric generating plant, switchgear, overhead and underground mains, including the supply of a 50-kW crude-oil engine set, accumulators, &c. (See this issue.)

Manchester.—March 28th. Electricity Department. Six months' supply of electric cooking ranges, switches and fuses, and electric kettles. (March 14th.)

March 26th. Education Committee. Electric lighting installation at Blackley, Chapel Street, and Crumpsall Lane Municipal Schools. S. Hey, Director of Education, Education Offices, Deansgate, Manchester.

New Zealand.—Wellington.—July 29th. Public Works Department. Turbines and generators.*

Rhondda.—March 31st. Electricity Department. A.c. house service meters, cables, joint boxes, &c., for 12 months. (March 7th.)

Salford.—March 24th. Electricity Committee. Service cables and accessories. Specification No. A.P.S. 16. Coal- and ash-transformer plant. Specifications from Mr. J. A. Robertson, consulting engineer, Brazennose House, 20, Brazennose Street, Manchester.

Skipton.—Installation of electric light in Skipton Grammar School, Gargrave Road. Mr. Edgar Wood, Clerk to the Governors, Bank Buildings, Skipton.

South Africa.—Durban.—May 2nd. Water Engineer's Department. Shongweni Scheme, Vernon Hooper Dam. Large sluice valves, pipes, water turbine generating plant, &c.*

Southampton.—March 26th. Electricity Department. One 1,000-kW rotary converter set with transformer and starting panel. (March 7th.)

Stockton-on-Tees.—March 24th. Electricity Department. Three-core e.h.p. (11,000 V) cables, 4-core l.p. cables, and 4-wire l.p. overhead line. (March 14th.)

Truro.—April 19th. City Council. Work connected with the proposed electricity undertaking. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Aberystwyth.—Town Council. Accepted:—
Electrically-driven pumping plant for the sewage works.—Boving Engineering Co.
Electrically-driven screens and raking apparatus.—S. S. Stott & Co.

Aylesbury.—Town Council. Accepted:—
860 yd. of main cable (£253).—Watshams, Ltd.
Centrifugal pump (£32).—Pulsometer Engineering Co., Ltd.

Belgium.—Five concerns—three Belgian and one each Italian and Czecho-Slovakian—last week submitted tenders to the municipal authorities of Brussels for the supply of the electric cables and accessories required up to December 31st next. The lowest offer (885,880 fr.) was that of the Société des Câbleries et Corderies du Hainaut, of Dour.

International competition was again a feature of the tendering for Belgian State railway cable contracts in Brussels on March 5th, when offers were received from ten concerns—five Belgian, and one each French, Dutch, Danish, Czecho-Slovakian, and British (Callender's Cable and Construction Co., Ltd.). For the supply of 695 metres of armoured cable, with terminal boxes and insulating material, the lowest bid was that of the Société des Câbleries et Corderies du Hainaut, of Dour (19,549 fr.). For the supply and laying of two lots of underground cables, the lowest tenders were respectively those of the Société des Ateliers de Constructions Electriques de Charleroi, and the Société de la Manufacture de Câbles Electriques en Caoutchouc, of Eupen.

Bolton.—Electricity Committee. Accepted:—
Motor-driven turbine pump for Back-o'-th'-Bank generating station.—Mather & Platt, Ltd.

Gas Committee.
Electric lift for new workshops, &c., Spa Road.—Wm. Wadsworth and Sons.

Blackburn.—Board of Guardians. Accepted: —
Electric lighting and power installation at the Union Laundry.—C. T. Briscoe & Son. The contract price was £255. Seventeen tenders were received.

Bradford.—Board of Guardians. Accepted:—
Installation of electric light at Daisy Hill Institution.—Chas. Bell, Ltd.
Installation of electric light at the stores, Bowling Institution.—Smith and Croft.

Carlisle.—Electricity Committee. Accepted:—
6,000-kW turbo-alternator condensing plant, &c. (including the sum of £5,559 in respect of the condensing plant, for which the Mirrlees, Watson Co., Ltd., will be the sub-contractors), £27,119; switchgear and protective gear, £12,429.—British Thomson-Houston Co., Ltd.
Boiler house and equipment (£55,440).—Stirling Boiler Co., Ltd.
Overhead travelling crane (£2,300).—Alexander Jack & Co., Ltd.

France.—Paris.—French State Railway authorities.
8,000 metres of lead-covered rubber-insulated twin conductor cable.—La Société de la Canalisation Electrique.

Heywood.—Electricity Committee. Accepted:—
Apparatus required in connection with an a.c. supply to Messrs. Pearson, Morton & Co., Ltd.:—
Motors and starting gear.—Electric Construction Co., Ltd.
Transformer.—General Electric Co., Ltd.
Alterations to engine room.—Samuel Barker.
E.h.p. cable.—W. T. Henley's Telegraph Works Co., Ltd.
E.h.p. cubicle.—General Electric Co., Ltd.

India.—The following contracts have been placed by Messrs. Handcock & Dykes in connection with extensions of the United Provinces Electric Supply Co.'s stations at Lucknow and Allahabad, India:—
Lucknow.
Water cooler (£504).—Heenan & Froude, Ltd.
Mercury-vapour rectifier (£1,334).—Hewittic Electric Co., Ltd.
H.p. switchboard (£951).—Ferguson, Pailin, Ltd.
Sub-station switchgear.—(£169).—Ferguson, Pailin, Ltd.
H.p. cable (£935).—British Insulated & Helsby Cables, Ltd.
Allahabad.
One 270-kW oil-driven d.c. generator, coupled to a Ruston & Hornsby vertical engine (£5,653).—Electric Construction Co., Ltd.
Water-softening plant (£652).—W. Boby & Co., Ltd.

London.—Metropolitan Asylums Board.—Installation of X-ray apparatus, Colindale Hospital:—

Watson & Sons (Electro-Medical), Ltd. (Accepted.)	**£234**
Medical Supply Association, Ltd.	237
A. E. Dean & Co.	278
Newton & Wright, Ltd.	285
Schall & Son	290
Cox-Cavendish Electrical Co., Ltd.	310
X-Rays, Ltd.	326

Shoreditch.—Lighting Committee. Accepted:—
Additional h.p. switchgear for the Whiston Street extension (£1,155).—British Thomson-Houston Co., Ltd.

Stepney.—Electricity Supply Committee. Supply of cable for 12 months. Accepted:—

Hackbridge Cable Co., Ltd.	£7,693
W. T. Henley's Telegraph Works Co., Ltd. (Recommended.)	**7,945**
W. T. Glover & Co., Ltd.	8,063
British Insulated & Helsby Cables, Ltd.	8,079
Pirelli-General Cable Works, Ltd.	8,084
Siemens Bros. & Co., Ltd.	8,111
Western Electric Co., Ltd.	8,133
Macintosh Cable Co., Ltd.	8,322
Callender's Cable & Construction Co., Ltd.	8,513

2¼ tons lead sheet (£113).—Locke, Lancaster & Johnson & Sons.
2 tons plumber's and ½ ton tinmen's solder (£282).—G. W. Neale, Ltd.
50 tons pitch (£207).—Crow, Catchpole & Co., Ltd.
1,000 rolls 1-in. white tape (£83).—J. Machennan & Co.
300 tons Lanarkshire washed singles (30s. per ton) and 1 barge Scotch-washed pea nuts (27s.).—J. Hudson & Co., Ltd.

St. Pancras.—Electricity and Public Lighting Committee. Recommended:—
Providing and fitting the two boilers now awaiting installation at the King's Road station with the "Lopulco" system of pulverised fuel in lieu of the mechanical stokers contemplated, at a cost of £7,820.—Underfeed Stoker Co., Ltd.

War Office. Accepted:—
400 steel boxes.—Edison Swan Electric Co., Ltd.

Middlesbrough.—Electricity Committee. Accepted:—
1,500 yd. .5 x .5 x .5 4-core l.p. cable (£2,250).—British Insulated and Helsby Cables, Ltd.
1,400 yd. 3½ in. x 3½ in. troughing, complete (£93).—Metallic Electrical Engineering Co., Ltd.
1,500 yd. .2 x .2 x .2 3-core cable (£1,042).—Enfield Ediswan Cable Co., Ltd.
880 yd. 2 in. by 2 in. troughing, complete (£40).—Crossley & Sons, Ltd.
Two 100-kVA three-phase transformers (£283).—Ferranti, Ltd.
Three 150-kVA single-phase transformers (£126 each).—General Electric Co., Ltd.
Three 300-kVA single-phase transformers (£244 each).—Ferranti, Ltd.
Two 2,500-kVA three-phase transformers (£1,526).—Ferranti, Ltd.
Fourteen (type S) switch pillars (£54 each).—Metropolitan-Vickers Electrical Co., Ltd.

Sheffield.—Electric Supply Committee. Accepted:—
22-in. low-lift motor-driven horizontal centrifugal water pump at Neepsend power station (£332).—Worthington, Simpson, Ltd.

Wolverhampton.—Town Council. Accepted:—
Approx. 3¼ miles 6,000-V cable at £1,416 per 1,000 yd., plus £750 for contingency expenses.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of makers or suppliers of:—

Dining room coronas or pendants (all wood).

Up-to-date Sarawak.—In the course of a recent lecture at the Royal Society of Arts, in London, on the progress of Sarawak, Borneo, the Hon. T. G. Cochrane stated that since the development of the oil resources of the district the village of Miri, which in 1909 had a population of 80 natives all told, had grown into a town possessing railways, electric lighting, and an automatic telephone exchange far in advance of anything provided by the Post Office in London.

Forthcoming Events.

Institution of Mechanical Engineers.—Friday, March 21st. At the Institution, Storey's Gate, S.W. At 6 p.m. Presidential address by Mr. W. H. Patchell.

Friday, March 28th. Joint meeting with the Institution of Civil Engineers. At the Institution, Storey's Gate, S.W. At 6 p.m. Discussion on "The Report of the Joint Committee on Standard Tests for Hydraulic Power Plants."

Royal Institution of Great Britain.—Saturday, March 22nd. At 21, Albemarle Street, W. At 3 p.m. Lecture on "Properties of Gases in Vacua," by Prof. Sir Ernest Rutherford, F.R.S. (Lecture III.)

Electrical Power Engineers' Association (Birmingham and District Section).—Tuesday, March 25th. At the Chamber of Commerce, Birmingham. At 7.30 p.m. Lecture on "Combustion and Boiler-house Efficiency," by Mr. J. N. Waite.

Radio Society of Great Britain.—Wednesday, March 26th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6 p.m. Lecture on "The Possibility of Electrical Television both with and without Wires," by Mr. A. A. Campbell Swinton.

Friday, March 28th. Informal Meeting. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6.30 p.m. Discussion on "High-pressure Supply for Valve Transmitters," to be opened by Mr. Hogg.

Institution of Electrical Engineers.—Thursday, March 27th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "The Future of Main-line Electrification on British Railways," by Lt.-Col. H. E. O'Brien.

(North-Midland Centre).—Tuesday, March 25th. At the Hotel Metropole, King Street, Leeds. At 7 p.m. Informal discussions: "Desirability of a Standardised Set of Supply Regulations," to be opened by Mr. A. F. Carter; and "Disadvantages of Electricity from the Users' Point of View," to be opened by Mr. T. B. Johnson.

(North-Eastern Centre).—Monday, March 24th. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Paper on "The Future of Main-line Electrification on British Railways," by Lt.-Col. H. E. O'Brien.

Belfast Association of Engineers.—Thursday, March 27th. At the Municipal College of Technology. At 7.30 p.m. Popular lecture, "Wave Transmission."

Junior Institution of Engineers.—Friday, March 28th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette on "Wood Wool: its Manufacture and Application," by Mr. A. J. Simpson.

National Council of Technical Staff Associations.—Friday, March 28th. At the Milton Hall, Deansgate, Manchester. At 7 p.m. Public meeting. Chairman, Mr. C. H. Wordingham, C.B.E.

Notes.

The Engineers' Club (London).—The professional meetings that are being held at the Engineers' Club this month number 22, and concern 19 different associations. It is evident that the club is proving of service, not only to its members, but also to engineers in general.

Appointments Vacant.—Technical assistant in the Inspection Branch of the L.C.C. Fire Brigade Department (£265). Charge engineer for the Doncaster Corporation Electricity Department. Charge engineer for the Stalybridge, &c., Joint Board. Engineer-in-charge for the Hammersmith Borough Council Electricity Department. (See our advertisement pages to-day.)

The Shannon Scheme.—As the result of Press interviews with a number of electrical engineers and others interested in hydro-electrical undertakings in the Irish Free State, the *Irish Times* obtained further information on the above subject, which is absorbing a great deal of public attention. Mr. R. L. Raul, T.C., chairman of the Dublin Corporation Electric Lighting Committee, mentioned that the Corporation was the first public body to take up practical hydro-electrical schemes on Irish rivers. He was amazed that any individual or firm in any particular country should be given a monopoly in the drafting of a scheme. No notification of the proposed undertaking had been given, although there were countries where electrical power schemes had reached a higher standard than in Germany. The consideration of the Liffey scheme should not be prejudiced, and the arrangement between the German firm and the Government should not be carried out.

Major J. Sproule Myles, T.D., Ballyshannon, regretted very much that the Ministry had not seen its way to throw the scheme open to world-wide competition, and thus secure the best available results.

Mr. P. A. Spalding, M.I.E.E. (Dundalk) described the harnessing of the Shannon as a work of great national importance, and deprecated the creation of a monopoly. The first step that should have been taken, in his opinion, was to get the best expert advice available, prepare a scheme, and arrange for its carrying out in a manner that would tend towards the general welfare of the country.

Mr. D. McDowall Grosart, A.M.I.E.E., manager of the Lucan Electric Railway Co., suggested that the Government should offer a premium to firms of undoubted standing to draw up a scheme, or schemes, not only with reference to the Shannon, but all the other rivers in the Free State, with the object of exploring and ascertaining their capabilities.

Mr. G. Marshall Harriss, M.I.E.E., general manager, Dublin United Tramways Co., was perfectly satisfied that the river was not capable of being developed on commercial lines to supply the whole of the Free State. He advocated an examination of all the rivers of the Free State with a view to their being linked up, if that were considered advisable.

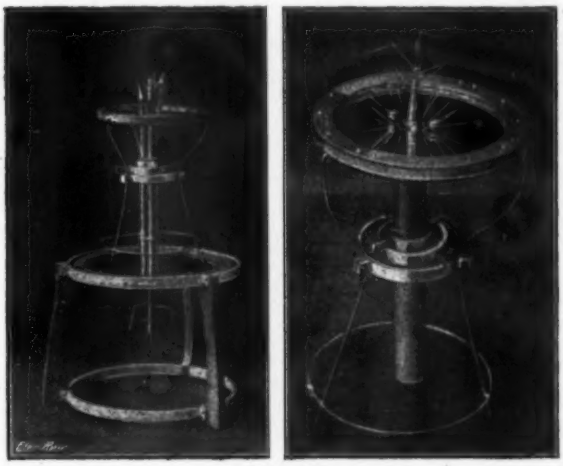
Mr. William A. Ryan (Killarney) said that he was not aware that the Government had any power to enter into this contract with a German firm, and thought that no contract should be entered into without advertising for tenders.

Mr. S. L. R. Price, electrical engineer, Pembroke, expressed the opinion that in a scheme of such enormous importance the Government should have, first of all, obtained expert independent advice.

Mr. J. A. Kenny, A.M.I.E.E., of the firm of Messrs. J. P. Tierney & Co., consulting engineers, Dublin, spoke for about a dozen small supply undertakings throughout the Free State. He was very glad to see that the Government was about to spend money on the development of the resources of the country, and he hoped that the Shannon would not be the only scheme. But he believed that the Government did not go about these things in the right way. It should have got independent technical advice before handing over everything to a firm of contractors.

Mr. William Hewat, T.D., president of the Electricity Supply Association of Ireland, said that every member of the Association was keenly interested in the question of the development of the Shannon. They were surprised, however, that correspondence such as that published in the newspapers should form the basis of a contract giving a monopoly of the whole undertaking to one particular firm and excluding possibilities of competition from other sources. He thought the Association would take grave exception to the manner in which the Shannon scheme was being handled by the Ministry.

Magnetic Toys.—Before the meeting of the Institution of Electrical Engineers last week, Mr. W. Brooks Sayers gave a demonstration of a variety of interesting magnetic devices which he has evolved, the success of which is largely due to the use of cobalt-chrome magnet steel. The accompanying illustrations show two of his apparatus. That on the right consists of a horizontal plane mirror, beneath which a vertical magnet is mounted on gimbal bearings, so that it is free to rotate like a conical pendulum. Steel balls, pins, &c., dropped on the mirror perform curious antics and gyrations when the magnet is set swinging, and the behaviour of the balls and



Magnetic Toys.

pins added one by one when the magnet is stationary is interesting and instructive. The pins take up symmetrical positions resembling geometrical figures, which change as the number of pins is varied.

The illustration on the left hand shows a more elaborate apparatus, with a compound magnet. Small paper figures attached to steel balls or pins bow and gyrate in a ludicrous way when the magnet is set in motion.

Mr. Sayers has also fitted conical expanding polar extensions to straight bar magnets, with which he produces curious results. The devices are being patented.

"Safety First."—On March 12th an exhibition of films designed for use in accident-prevention campaigns in industrial works was given at Westminster, under the auspices of the Industrial Welfare Society. The exhibition was attended by a number of representatives of London industrial firms.

New U.S. Turbine-Generator System.—The first practical application in the United States of the principles of high pressure and reheating in turbines is being made with the installation at the Philo, Ohio, plant of the Ohio Power Co., a subsidiary of the American Gas & Electric Co., the first set of which was recently shipped by the General Electric Co. High-pressure transmission lines are to be tied in on one side of this station as far east as Pittsburgh, and eventually as far west as Chicago. The set referred to is the first of six to be ultimately installed. Each is a 35,000-kW, 1,800-r.p.m., 11,000-volt, 60-cycle, single-cylinder turbo-generator arranged for reheating and multi-stage extraction. It will operate at 600 lb. steam pressure and 725 deg. F. steam temperature. "The entire project is a practical step in the super-power conception now being agitated, and is a definite move towards the conservation of natural resources."—*Reuter's Trade Service* (New York).

Local Societies.—"Faradism."—At a meeting of the Edinburgh Electrical Society, held on March 7th, Mr. M. McLaren, C.S.M.M.G., delivered a lecture on "Faradism." The lecturer covered the field of medical electricity in its many applications, and concluded with a practical demonstration on a patient, illustrating the effects of Faradism and galvanism.

Interruptions of Supply.—At a recent meeting of the Glasgow Corporation Electricity Department Engineering Society, Mr. C. W. Marshall read a paper entitled "A Review of Interruptions." At the outset Mr. Marshall stated that the natural tendency of supply authorities was to keep the number and details of their breakdowns to themselves, but he was of the opinion that the need for continuity was so important that it seemed to be inevitable that sooner or later the State would be forced to make searching inquiry into every failure which occurred in electricity undertakings in the same way as was at present done in connection with railway and mining accidents. Mr. Marshall then dealt with the experiences of the Glasgow Corporation Electricity Department during the year ended February 29th, 1924, under the following headings:—(1) General statistics, with notes on important faults which occurred in the period under consideration. (2) Division of faults among the different pieces of apparatus which gave rise to trouble. (3) Steps which are being taken to improve the safety of the system. The chairman of the Society for next session is Mr. W. Ross, and the vice-chairman Mr. D. Denholm.

Radio Amplifiers.—An informal meeting of the Radio Society of Great Britain was held on March 12th, at which Mr. F. Phillips opened a discussion upon "Amplifiers for Short-Wave Reception."

Registration of Electrical Contractors. — Mr. Alec. Lindsay read a paper on "The Registration of the Electrical Contractor" at a meeting of the Electrical Society of Glasgow on March 4th, when Mr. George Morgan, chairman of the Society, presided, and there was a large attendance of members. Mr. Lindsay indicated the aims and objects of registration, and outlined the negotiations which had led up to the framing of the scheme. He then described the scheme in detail, explained the various clauses, and demonstrated the advantages of the scheme.

Textile Mill Driving.—At the Bradford Engineering Society, recently, Mr. R. Hattersley being unable to deliver his promised lecture on power production and transmission for mill-driving purposes, a general discussion took place on modern developments in the electric driving of textile mills, opened by Mr. J. W. Longley, deputy chairman of the Bradford Electricity Committee, and consulting engineer. His own experience was that the group drive, if applied in proper divisions and sizes, would prove satisfactory and economical. In spinning textiles it was probable that coupling direct might be suitable, but in almost every other branch of textiles without the adoption of low-speed motors (which were very costly by comparison with those of medium speeds), it would not be satisfactory to couple direct. With the present chains and gears there was really very little to choose between the different methods. He did not favour the suspension of motors from floors, both because of the difficulty of handling and because the whole weight was carried on the bolts. It was preferable to mount the motors on a staging and to drive on the centre of shafts. Messrs. C. E. Allsop (sales manager to the Bradford Corporation Electricity Department and ex-chairman of the Society), Mr. H. Moss (electrical contractor), Mr. H. Brown, and Prof. G. F. Charnock, head of the engineering department of the Bradford Technical College, also contributed to the discussion.

Motor Car Dynamos and Starters.—At a meeting of the Derby graduates of the Institution of Automobile Engineers, held in Derby, Mr. West read a useful paper on "Dynamos and Self-starters."

Induction Motors.—At a meeting of the Norwich Engineering Society students recently, Mr. A. B. Catling, Student Inst.C.E., read a paper entitled: "Induction Motors." The paper was of an instructive nature, and the author dealt with a difficult and somewhat obscure subject in a lucid manner. The principle of the rotating field was clearly demonstrated, and various designs of induction motors by different makers were discussed. A number of lantern slides, with explanatory diagrams, were shown on the screen. The chairman (Mr. C. J. Jewell) complimented Mr. Catling on his paper, which he understood was his maiden effort, and a discussion followed.—*Eastern Daily Press.*

Reports on Railway Accidents.—Major G. L. Hall has reported to the Ministry of Transport upon the circumstances attending an accident which occurred at South Gosforth East Junction, near Newcastle, on December 18th last. This was a collision between a mineral train and an empty electric passenger train. The driver and fireman of the mineral train were killed and considerable material damage was caused. Major Hall, after exhaustive inquiries, finds that the occurrence was apparently due to the passing of a danger signal by the driver of the mineral train, which caused the train to run into the electric train which was overlapping a crossing.

Major Hall has also made a report upon a collision which occurred at Crewe (L.M.S.R.) on January 9th, when several passengers were slightly injured. The collision occurred between a passenger train and four standing coaches, and is stated by the inspector to have been due to a signalman inadvertently pulling a wrong lever, permitting the passenger train to proceed into the station.

Major Hall says that in a busy box, such as the one concerned, occasional mistakes of the kind are not unnatural, and it is to the credit of signalmen generally that they are relatively infrequent. "It is a commonly-accepted principle that when high frequency of traffic, complexity of the layout, inadequate view of or opportunity for observing all movements, or other special conditions exist, some automatic assistance to the signalmen is called for, such as is provided by track circuiting, whereby the actual presence of a train prevents the incorrect lowering of a signal for a following movement. This case is a typical example of the class of accident which track circuiting has been devised to prevent, and Crewe Station is certainly a location where its installation is desirable." The company is in agreement with this view, and a scheme of track circuiting is now in hand.

Col. J. W. Pringle has rendered his report upon a collision which occurred at Cardiff (G.W.R.), on December 16th last, between an express train and an almost stationary light engine. He finds that the accident was due to a signalman's forgetting the presence of the light engine. The driver or the fireman of the engine should have gone to the box to remind the signalman of the light engine. The starting signal, which was the one concerned, is said to be in full view of the signal box, and it would not normally be considered a post where track-circuit protection was primarily necessary. Other conditions, however, are against this, and the inspector hopes, therefore, that consideration will be given to the question of track-circuiting at this point as soon as possible.

Social Events.—Institution of Engineering Inspection Dinner.—The Institution of Engineering Inspection held its annual dinner at the Hotel Cecil on March 5th. Mr. Francis R. Wade, the president, was in the chair. Sir Halford Mackinder, chairman of the Imperial Shipping Committee, proposing the toast of the Institution, said that there was danger of the standard of living in this country being lowered to the level of the standard in certain competing nations. In the Empire and the United States there were communities which could afford the good article, and if they were going to find salvation on the higher and not the lower plane, it was going to be among those communities. It was the function of the Institution to see that in all directions the standard of work was maintained with ood faith.

The President, replying, said that during the four years from 1919 to 1922 the imports into this country exceeded the exports in value by £1,500,000,000. Had that money been used in industry it would have provided employment for over 3,000,000 people at the rate of £3 per week. That was the reason why they were faced with the tragedy of the closing down of one after another of the great industries of this country. The Institution had made it its duty to endeavour to raise the standard of manufacture, so that, in spite of deflated currencies in other manufacturing countries, they were yet able to hold their own in many markets.—*The Times.*

E.P.E.A. Annual Dinner.—The fifth annual dinner of the Northern Division was held at the Victoria Hotel, Manchester, on March 8th. About a hundred members and ladies were present. The guests, who were welcomed by Mr. G. E. Smith, chairman of the division, and Mrs. Smith, included the president and no fewer than three past-presidents of the Association. The National and District Joint Boards, respectively, were represented by Alderman Walker, chairman of the former, and Alderman Clark, chairman of the D.J.B. for No. 3 Area.

In proposing the toast of "The National and District Joint Boards," Mr. J. F. Heslop, past-president, remarked upon the pleasure with which he welcomed the attendance of the two gentlemen named. The N.J.B. was composed of able men on both sides, and, although there had been contentious views expressed, he was glad to say there had only been one serious rupture in its history. Much of its success was due to the sincerity and diplomacy of the chairman.

Alderman Walker said that the N.J.B. had done its work well, and he believed both sides of it were sincere. Touching upon the rupture referred to by Mr. Heslop, he said the employers were convinced at the time of its occurrence that their view was right, and they were of the same opinion to-day. Sincerity was the whole spirit of Whitleyism, and he believed the E.P.E.A. was equally sincere in its views.

Alderman Clark proposed the toast of "The Association," and Mr. T. A. G. Margary, president of the E.P.E.A., replied. Mr. A. L. Lunn, past-president, proposed the toast of "The Guests and Ladies" in a happy speech, to which Mr. W. J. Oswald, the immediate past-president, responded. During the evening a very enjoyable programme of music was provided.

The Turbine Explosion at Shanghai.—The report of Messrs. Parsons's representatives regarding the turbine explosion at the power station of the Shanghai Municipal Council on November 15th, says that the evidence suggested that the accident was caused by the breaking of a turbine shaft, all other damage being consequential. When the shaft parts were co-related a longitudinal irregular fracture was disclosed, indicating that a fault developed during the forging. The nature of the fracture suggests that the final breaking of the shaft was instantaneous, giving no warning to those responsible for the running of the machinery.—*Reuter* (Shanghai).

Showrooms and Sales Departments.—A sales conference organised by the E.D.A. Provincial Area Sub-Committee (West Riding (Aire and Calder) Electricity District), and held on March 6th at the Bradford Corporation Electricity Offices, Mr. T. Hall, A.M.I.E.E., Borough Electrical Engineer and Tramways Engineer, Burton-on-Trent, read a paper on "Showrooms and Sales Departments." There was a good attendance, and many of the points raised in the paper were discussed by the contractor members and supply undertakings' representatives. It is anticipated that there will be a good attendance at the next conference, which is to be held in Leeds on April 3rd, when Mr. F. Smith and Mr. S. C. Hurry, of the Jackson Electric Stove Co., Ltd., will lecture on "The Historical Development of Electrical Cooking Apparatus," and "Electric Cooking Apparatus from a Manufacturer's point of view."

Wireless Power Transmission.—The New York correspondent of the *Daily News* reports that, in an interview, Nikola Tesla, the electrician and physicist, declares that he can transmit power through the earth itself, instead of through cables or by means of Hertzian waves. "I can now definitely announce," he says, "that loss in transmission to the greatest terrestrial distance, say 12,000 miles, will not amount to more than a quarter of one per cent. This does not take into account certain unavoidable losses in the transmitter and the receiver, amounting to about 4 per cent. in the aggregate. My discovery shows that the most complex and rapid electrical oscillations, human speech, and even power, can be transmitted through the earth far better than through a cable or other artificial conductor."

The Copper and Lead Outlook.—A correspondent writes: "The Editorial comments in the last issue of the REVIEW with regard to the position of the copper and lead markets have during the past week received confirmation not only from experts in the commercial world, but also from scientific men. Thus at the meeting of the Institute of Metals last week Prof. Thomas Turner, the new president, stated that it was probable the supply of certain base metals, including copper and lead, would be exhausted before either coal or iron ceased to be produced. Owing to the limited way in which the base metals were concentrated in the earth's crust, it was impossible to use the average rock which contained small quantities of copper and lead; only those local concentrations which had been brought about by natural processes could be turned to commercial use. It was evident, therefore, that the future of the non-ferrous metal industry depended on the extension of scientific knowledge in the direction of broadening the source of supplies, diminishing the cost of extraction, and improving the methods of treatment. Even after allowing for improvements in these directions, it was clear that the supply of these base metals in future was likely to be restricted to an extent which had not hitherto been contemplated. The commercial aspect of the subject was also exhaustively dealt with by Mr. C. Vincent Sale in his speech at the annual meeting of the British Metal Corporation in London last week. During the course of his remarks Mr. Sale gave some figures which indicate an uninterrupted movement towards a volume of production and consumption which, with the exception of spelter, now exceeds the pre-war standard. Taking 100 as the annual average of the world's production in the three years 1911-13, his estimate of the position at the present time was as follows, the figures for 1923 being estimated:—

	1921	1922	1923
Copper			
Production	57	91	123
Consumption	59	96	115
Lead			
Production	74	93	101
Consumption	70	90	101

It will be seen that the figures confirm those given in the REVIEW last week, and that the position is more serious as regards lead than copper, the latter being the one non-ferrous metal in which the increase in demand has not been so great as the progress in output. As regards lead, it will be seen that the demand is progressing at a faster rate than the output."

Fatigue Failure of Brass Tubes.—At a meeting of the Institute of Metals, on March 12th, Mr. W. E. W. Millington and Prof. F. C. Thompson, D.Met., described a curious failure of brass tubes in a feed-water heater—with a consideration of the nature of fatigue. By a process of elimination the cause of failure was diagnosed as "fatigue," due to vibration of the tubes. New tubes, suitably stayed, were fitted and the trouble ceased, but in the account of the investigation, involving a study of the close-packed cubic material, the authors show how a movement on octahedral planes, which they term "easy glide" in distinction to "slip," is responsible for plastic deformation in hot and cold working, changes of packing from cubic to hexagonal, mechanical twinning, and fatigue. Stress-strain diagrams are discussed taking the "easy glide" into account. This is developed to show the movement which will take place in an aggregate of crystals under cycles of stress, and that, in certain circumstances, twin bars (Neumann lamellae) are cumulatively formed in the material which not only stiffen the crystals, but also cause them to become internally stressed, until eventually failure results. This new "fatigue" theory of the authors is compared with the observed facts of the actual failure, and the nature of Neumann lamellae and slip bands is discussed at some length. The elastic limit is dealt with and conclusions are reached as to its connection with the fatigue limit, doubts being expressed as to the justification of thermal methods of determining the latter value.

The Scope for Heavy-oil Engines.—Mr. A. W. A. Chivers, in thanking the members of the Diesel Engine Users Association for electing him president for the current year, referred to the useful work carried out by the Association. There were grounds for being even more hopeful than in the past as to the future of the heavy-oil engine for land purposes, especially for the generation of electricity. There had been a time when practically the only type of generating plant that was talked about was the type which was considered suitable for super-power stations, and many people at that time were very much concerned lest the powers which were granted to the Electricity Commissioners should be exercised in a direction which would preclude the use of the Diesel engine. There were not the same grounds nowadays for the feeling that there would be undue restrictions on Diesel engines for the purpose of generating electricity that there had been, say, two years ago. His view was that the policy of erecting super-power stations in this country was right, but that the scheme had yet to be developed. As the population of this country became still more dense there would undoubtedly be very strong grounds for taking supplies from a super-power station, but that day in some districts had not yet arrived. There would always be scope for heavy-oil engines for the generation of electricity in the more sparsely populated districts, especially in districts where electricity supply was to be developed, and there were certainly many places in this country where, if a scheme was considered and dealt with on its merits, it could be shown that a supply of electricity could be given to the public at a cheaper price by means of such plant than could be done from super-power stations, because the one big factor that was so frequently omitted by advocates of the super-power station was the cost of transmission.

National Council of Technical Staff Associations.—Referring to the announcement in our last issue regarding the formation of the above Council, we are informed that the Engineer Surveyors' Association has provisionally agreed to become a constituent member of the National Council, subject to the ratification of the members.

Institution Notes.

Institution of Electrical Engineers.—INFORMAL MEETING.—At the meeting of the Informal Section, on March 10th, Mr. A. G. Hilling was in the chair when Mr. J. Tribot Laspière opened a discussion on the "International Conference on Extra High Pressure Lines." Mr. Laspière, who is general secretary of the Union des Syndicats de l'Electricité, was introduced by Mr. C. D. Le Maistre, C.B.E., general secretary of the International Electro-technical Commission. Mr. Le Maistre read Mr. Laspière's paper describing the genesis and scope of the International Conference, and "stood by" as interpreter during the lucid description Mr. Laspière gave of the hydro-electric developments in France. Mr. Laspière appealed to English engineers to attend and to take more interest in this International Conference, which in no way overlapped the functions of the International Electro-technical Commission, for (1) its object was the examination of a single question only, which was defined in advance in the title of the Conference; (2) the investigation was to be undertaken not in a scientific spirit, but from the purely *practical and industrial* point of view; (3) the Conference was to be limited simply to an exchange of ideas and information, and was not in any way to culminate in international rules and regulations. The Conference admitted as independent members all qualified persons who wished to take part. French and English were the two official languages, yet the delegates from Belgium, Holland, Spain, and even Japan, outnumbered those from England. Mr. Laspière described the industrial need for cheap power in France. With a total production of 40,000,000 tons of coal, 25,000,000 tons had to be imported. Of this 20,000,000 tons came from England and 5,000,000 from Germany, and this dependence was a very serious consideration for the French. They had turned their minds to the nine or ten million h.p. available in water-power, and it was shown how the water-power of the Swiss frontier failed in the winter months, while that of the centre of France was at its maximum—this position being reversed in the summer, hence the need for connecting those districts.

An interesting discussion on French practice followed. Colonel K. Edgcumbe elicited the fact that the coal-fed stations of France at present cost only slightly more than the water-power ones, the reason being that all the stations were established among consumers and had no transmission losses, whilst hydro-electric plant was installed at the very high costs prevailing during and since the war. Messrs. J. Coxon, P. Dunsheath, C. L. Fortescue, P. Good, A. G. Hilling, P. V. Hunter, A. Jacob, R. Borlase Matthews, W. E. Rogers, and Dr. E. H. Rayner also spoke.

Institution of Engineers-in-Charge.—On Saturday last the annual dinner of the Institution was held at the Holborn Restaurant, and was well attended; Mr. T. Cooper, M.Inst.C.E., president, was in the chair. After the loyal toasts, Captain H. Riall Sankey, C.B., C.B.E., proposed "The continued necessity for research," and pointed out that the men and the equipment for research were available: all that remained necessary was the funds. Research must be carried on upon a much larger scale, and they should impress on manufacturers the necessity of supporting it.

Dr. Alex. Russell (president, I.E.E.) responded, cordially endorsing the sentiment. He stated that the United States was ahead of this country in respect of research laboratories, but scientific progress was not proportional to the number of laboratories, and this country was second to none because it possessed many researchers of the highest ability.

Mr. W. H. Patchell (president, I.Mech.E.) proposed "The Institution," congratulating it upon its incorporation last year. He pointed out that its new standing carried with it greater responsibilities, and he urged the members to live up to it.

Mr. Cooper, in reply, referred to the qualifications required for membership, and to the great economies that had been effected by the employment of competent engineers-in-charge as compared with the waste of past years. On the social side the Institution was also active, and its visits to works were of great interest and value to the members.

Afterwards the president, in the name of the members, made a presentation of a silver tea service to Captain A. E. Penn, M.I.Mech.E., in recognition of his valuable services to the Institution during the past 19 years; for the past 12 years he had been hon. secretary, and he had recently brought to completion the incorporation of the Institution. There was also a gift of jewellery to Mrs. Penn.

Captain Penn, to whom the presentation was a complete surprise, expressed his deep appreciation of it, and added the hope that some day they would have a secretary who could devote the whole of his time to the service of the Institution.

Mr. J. E. Watkins (chairman, Technics Committee), in an eloquent speech, proposed "Our Guests and Friends," and Colonel Sir Arthur R. Holbrook, K.B.E. (who, the proposer said, had six sons in the war, all of whom won distinction), responding, remarked that England never stood higher in the estimation of the world, but her position could only be maintained by research; he was sure they could secure the funds if they made up their minds to do so.

Lastly, Mr. C. A. Pickles (vice-chairman of the Institution) proposed the health of the President, who was responsible for the engineering of 24 public institutions, accommodating 19,500 sick persons and the corresponding staffs. In his reply the President acknowledged the valuable assistance he received from the engineers-in-charge under him at the various institutions.

Amongst the guests not named above were Lt.-Col. L. R. F. Fell, D.S.O. (Research Department, Air Ministry), Mr. L. Gaster, Mr. H. G. Burford (president, I.A.E.), Mr. Alex. Ritchie, and Mr. K. C. Adams. A musical programme was performed during the evening, and the function was very enjoyable.

Royal Institution.—The Friday evening discourse on April 4th will be delivered by Sir Ernest Rutherford, on "The Nucleus of the Atom."

Junior Institution of Engineers.—On February 29th, Mr. W. A. Rhind, M.I.S.I., delivered a lecturette on "The Manufacture of the Incandescent Electric Lamp." He described the preparation of the tungsten filament and other components of the electric lamp, and gave a full account of the method of their assembly in the vacuum lamp, as well as in the ordinary and the pipless gasfilled lamps. Particulars of the pumping and gas-filling operations were given. The various shapes of filaments were distinguished, and the lecturer concluded with a short note on the manufacture of carbon filaments. An interesting discussion followed, in the course of which the lecturer explained the advantages of the pipless lamp, and answered questions relating to the ageing and blackening of lamps, and about neon lamps and tubes. On March 14th Mr. L. M. Jockel, A.M.I.Mech.E., read a paper on "Water-Tube Boilers." Mr. Jockel summarised the recent developments in water-tube boilers and indicated the present features and utility of that type. In dealing with the principal stresses in boiler drums and water-tubes, he said that the apparent factor of safety was enormous, but there were compound stresses present which could not be calculated and for which some allowance must be made. Discussing future developments, Mr. Jockel said he thought that pressures would increase above the present figure of 500 lb. per sq. in., but that temperatures would not probably exceed 800 deg. F. The Benson boiler recently constructed at Rugby would work at a pressure of 3,200 lb. per sq. in., and an experimental boiler said to be under construction for Chicago was designed for a pressure of 1,200 lb. per sq. in. with primary and secondary superheaters and an economiser. The steam and water drum was to be 4 ft. in diameter and to have a wall thickness of 4 in.

Institution of Railway Signal Engineers (Inc.).—The following dates have been fixed for meetings of the Institution during the 1924 session, which will be held at the Institution of Electrical Engineers at 6.30 p.m.:—April 9th: "A Survey of Eastern Signalling," by A. C. Rose. May 14th: Subject to be announced later. June: Annual summer meeting. July 9th: Subject to be announced later. October: Annual dinner. November 12th: "Signalling on the London Underground Railways," by W. S. Every. December 10th: Subject to be announced later. January 14th, 1925: Subject to be announced later. February 11th, 1925: Annual general meeting and presidential address.

Institution of Production Engineers.—The following gentlemen have been co-opted as members of the Council:—Messrs. H. A. Dudgeon, H. S. Locker, R. Mitchell, R. H. Hutchinson, Zieshang, and A. T. Davey. A Development Committee has been formed, to accelerate the progress of the Institution, consisting of Messrs. W. H. Dormer, W. Attwood, G. Hey, A. Butler, and A. T. Davey. Two bronze medals and premiums are to be awarded for the best paper and the best contribution to a discussion on a paper in each session.

Physical Society of London.—This week the Physical Society is celebrating the jubilee of its foundation by meetings held at the Institution of Electrical Engineers. Yesterday (Thursday) there was to be a reception by the president, Mr. F. E. Smith, C.B.E., F.R.S., followed by the delivery of the ninth Guthrie Lecture by M. le Duc de Broglie on "The Photo-electric Effect in the case of High-frequency Radiation," and, in the evening, a lecture by Sir Richard Paget, arranged by the Institution of Electrical Engineers, on "The Nature of Speech." To-day (the fiftieth anniversary) the meetings will be devoted to reminiscences and short discourses by original Fellows and others of long standing; Sir Richard Glazebrook, F.R.S., will give a discourse on "Electrical Measurements," and Sir Oliver Lodge, F.R.S., will deal with "Our Present Position regarding the Ether." To-morrow there will be a banquet at which the Duke of York, the Prime Minister, the Lord Chancellor, and other distinguished guests will be present.

An exhibition of apparatus first shown at meetings of the Society, and their modern developments, is being held at the Institution; it will be open from 2.30 to 8.30 p.m. to-day and from 2.0 to 4.0 p.m. to-morrow. Demonstrations of various apparatus and experiments are being given.

Delegates will attend the celebration from many foreign countries, and from scientific societies at home.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Kirkcaldy Corporation Joint Tramways and Finance Committee recommends that the salary of the chief electrical engineer, Mr. FRANCIS, be increased from £608 to £708 per annum, and that the question of his salary be again reconsidered at the end of a year.

Sunderland Corporation has promoted Mr. ROYAL, the distributing engineer of the electricity undertaking, to be second technical assistant and has fixed the salary in respect of the position under Grade 3, Class F, of the scale of salaries fixed by the National Joint Board (Electricity Supply Industry), plus £50 per annum.

Admiralty Orders issued on March 12th notify the appointment of Mr. W. J. BERRY, C.B., Director of Warship Construction, to succeed Sir Eustace d'Eyncourt as Director of Naval Construction. He will accordingly be responsible for the design of all British warships.

MR. E. L. BROOKS, who is leaving Petters, Ltd., of Yeovil, to join the staff of the General Electric Co., Ltd., at Witton, has been presented by his colleagues with a silver cigarette case.

On March 12th the Eston (Yorkshire) Urban Council considered the question of the appointment of its electrical engineer. The Electric Lighting Committee, after considering several proposals, recommended that the appointment of the Administrative Engineer, Mr. G. DIXON, should be allowed to lapse on March 31st, and that he be invited to act in a consultative capacity only at a salary of £50 per annum, this sum to be remuneration for all duties he might be called upon to perform. This proposal was carried, but at the Council meeting Councillor Fox moved that the minute should be referred back. The Council went into committee on the matter, and decided to appoint temporarily for one month as electrical engineer, Mr. C. H. STAGG, who has acted as resident engineer under Mr. Dixon. The recommendation that Mr. Dixon should be retained in a consultative capacity at £50 a year was defeated.

MR. T. D. CLOTHIER, for many years electrical engineer of Bootle Corporation Electricity undertaking, up to the time of its absorption by the Liverpool Corporation, is now permanently resident at Nilgherries, Hill Crest, Natal, South Africa.

MR. ALAN BARNES, chief engineer at Gatley and Cheadle electricity station, was married to Miss Elizabeth H. Harris, of Accrington, last week.

MR. C. R. E. WOOD and MR. EDWARD S. CARLING, both late of the General Electric Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd., have resigned their positions with the latter company and have commenced trading in partnership as Wood & Carling at Sentinel House, Southampton Row, W.C.1, as factors and dealers in all electrical supplies.

Whitehaven Town Council has increased the salary of the Borough Electrical Engineer from £500 to £600 per annum.

MR. JAMES BACON, for many years manager in Great Britain for Bolinder engines and also manager oil-engine department of Messrs. Wm. Beardmore & Co., has been appointed London manager of Messrs. Vickers-Petters, Ltd. Capt. R. C. Petter will remain in London as director and manager of Messrs. Petters, Ltd., Yeovil.

MR. C. SYLVESTER resigns his position on the staff of the British Thomson-Houston Co., Ltd., Lighting Service Department, as from 22nd inst.

Obituary.—SIR H. V. KILVERT.—We regret to record the death, which occurred at his residence at Ashton-on-Mersey on March 12th after a long illness, of Sir Harry Vernon Kilvert, aged 62 years. Sir Harry was chairman of Messrs. N. Kilvert & Sons, lard refiners, and he succeeded his brother as chairman of the Lancashire Dynamo & Motor Co., Ltd., of Trafford Park. The latter business was established by the two brothers. The deceased gentleman was keenly interested in public affairs and was knighted in 1921.

CAPTAIN H. L. THOMSON.—We regret to read in *The Times* of the death, from pneumonia, after a very short illness, of Captain Harold Lyon Thomson, M.I.E.E., of 34, St. James's Street. He was greatly interested in transport methods, and rendered invaluable service with the Army during the entire period of the war. He had been a member of the Institution of Electrical Engineers since 1898, and was 63 years of age.

MR. M. PARTRIDGE.—The death has taken place of Mr. M. Partridge, director of the Chudleigh (Devon) Light & Power Co.

MR. H. R. GREENOUGH.—We regret to learn from a correspondent of the death, which occurred at Southport on Friday last, of Mr. Herbert Ralph Greenough, a designer of electric trucks for use on railway station platforms. He was 47 years of age.

New Companies Registered.

Southend Radio Co., Ltd. (196,256).—Private company. Registered March 8th. Capital, £100 in £1 shares. To carry on the business of radio and mechanical engineers, electricians, &c. The first directors are:—F. A. Mayer, "Stilemans," Wickford, Essex, radio engineer; Mrs. B. E. Mayer, "Stilemans," Wickford, Essex; A. Kendrick, 126, Lymington Avenue, Leigh, mechanic. Qualification, £1 share. Remuneration as fixed by the company. Solicitors: Robbins, Olivery and Lake, 218, Strand, W.C. Registered office: 5, Central Arcade, Queen's Road, Southend-on-Sea.

Electric Services (Liverpool), Ltd. (196,191).—Private company. Registered March 6th. Capital, £1,000 in £1 shares. To carry on the business of electrical and steam engineers and contractors, suppliers for electricity, manufacturers of tramway, railway, electrical, magnetic, galvanic, and other apparatus, &c. The first directors are:—H. G. Wainscott, 9, Rochdale Road, Edenfield, near Manchester, Lancs., electrical engineer; G. Marshman, 18, Raymond Avenue, Bury, Lancs., electrical engineer; W. Powell, 28, Park Street, Radcliffe, Lancs., electrical engineer. Qualification, 50 ordinary shares. Registered office: 21, Mersey Street, Liverpool.

Childs' Electrical Stores, Ltd. (196,263).—Private company. Registered March 10th. Capital, £1,000 in £1 shares. To take over the business of electrical engineers and dealers in electrical goods, carried on by H. E. Childs and C. Davis at 72, Lancaster Road, North Kensington. The subscribers (each with one share) are:—A. M. Churchill, 85, Cornwall Road, North Kensington, W.11, electrical engineer; B. Levy, 21, Anerley Road, Westcliff-on-Sea, merchant tailor. The first directors are: H. E. Childs and C. Davis. Qualification, £10. Solicitors: Grover and Mills, 27, Queen Victoria Street, E.C. Registered office: 72, Lancaster Road, North Kensington.

Victoria Electric Plant Co., Ltd. (196,284).—Private company. Registered March 10th. Capital, £1,000 in £1 shares. To acquire the business of an electrical engineer heretofore carried on by N. E. Brevig at 8-10, Spenser Street, Westminster. The first directors are:—N. E. Brevig, "Belgrave," 61, Pollards Hill South, Norbury, S.W.16; Mrs. M. A. Brevig, "Belgrave," 61, Pollards Hill South, Norbury, S.W.16. Solicitors: W. H. Lane, 17, College Hill, Cannon Street, E.C.4. Registered office: 8-10, Spenser Street, Westminster, S.W.1.

H. T. Bourn, Ltd. (196,170).—Private company. Registered March 5th. Capital, £800 in £1 shares. To acquire the business of an electrical engineer and contractor, carried on by H. T. Bourn at 1a, St. Peter Street, Blackburn. The first directors are:—H. T. Bourn (permanent), Colleston, Ramsgreave, Blackburn; A. Sharples, 51, Logwood Street, Blackburn. Qualification, one share. Registered office: 1a, St. Peter Street, Blackburn.

City Electrical Appliances, Ltd. (196,323).—Private company. Registered March 12th. Capital, £5,000 in £1 shares. To exhibit and sell electrical apparatus and fittings at a showroom belonging to and provided by the Corporation of Leicester at Market Street, Leicester, or elsewhere. The first directors are:—J. Orringe, "Croyland," Knighton Drive, Leicester, electrical engineer; T. H. Wathes, "The Oaks," Westhill Road, Leicester, electrical engineer; B. Gill, 49, Winchester Avenue, Leicester, electrical engineer; T. S. Hurley, "Stanmore," Ashleigh Road, Leicester, electrical engineer; S. H. Webb, "Brockweir," Uppingham Road, Leicester, electrical engineer. Qualification, 200 shares. Remuneration as fixed by the company. Registered office: 14, New Street, Leicester.

Card Clothing and Belting, Ltd. (196,249).—Registered on March 8th, with a nominal capital of £650,000 in £1 shares (200,000 7½ per cent. cumulative preference and 450,000 ordinary). The objects are: To take over as going concerns and amalgamate the undertakings of Critchley Sharp and Tetlow, Ltd., A. Duckworth and Sons, Ltd., Fleming, Birkby and Goodall, Ltd., Joshua Lister and Sons, Ltd., W. V. Middleton, Ltd., James Taylor and Sons (Cleckheaton), Ltd., and W. H. Webster (Wirecards), Ltd., and to carry on the business of card clothing and card cloth manufacturers, needle and diamond point card and wood card makers, belting manufacturers, tanners, curriers and leather merchants, machine band makers, wire drawers and platers, india-rubber manufacturers and merchants, makers of card setting machinery, wire drawing and woollen and worsted machinery, electric wires and cables, &c., as carried on by the said companies, and that of Government or general contractors, dealers in raw products, mill owners, engineers, &c. W. E. Wright is first managing director. Secretary: D. Jeffrey. Solicitors: Scholefield, Taylor and Moggs, Batley. The registered office is East Parade Chambers, Leeds.

Rudolph Charles and Goff, Ltd. (196,279).—Private company. Registered March 10th. Capital, £1,000 in £1 shares. To carry on the business of suppliers of all kinds of electrical apparatus, electrical engineers and general house and shop fitters and furnishers, builders and decorators, &c. The permanent directors are:—Rudolph C. Randall, 146, Westwood Road, Ilford; Robert H. Goff, 55, Perth Road, Leyton, E.10. Qualification, 10 shares. Solicitors: Forbes and Son, 19, Mark Lane, E.C. Registered office: Beacontree and Goodmayes Market, Ilford, Essex.

Official Returns of Electrical Companies.

Illuminated Publicity, Ltd.—R. Atherton, of 28, Church Street, Soho, W.1, ceased to act as receiver on March 8th, 1924.

F. L. Mitchell & Co., Ltd.—E. S. Thorn, of 68, Coleman Street, E.C.2, ceased to act as receiver on February 18th, 1924.

Bastian Electric Co., Ltd.—Particulars filed of £2,000 and contingent bonus of 100 per cent. prior lien debentures authorised February 12th, 1924, charged on the company's undertaking and property, present and future, the amount of the present issue being £1,800.

Notting Hill Electric Lighting Co., Ltd. (jointly with the Kensington and Knightsbridge Electric Lighting Co., Ltd.).—Particulars filed of £150,000 debentures authorised January 11th, 1924, charged on freehold land near Wood Lane, Hammersmith, with the generating station thereon, the amount of the present issue being £100,000.

Satisfaction in full on February 19th, 1924, of debenture stock dated September 29th, 1908, securing £50,000.

Kensington and Knightsbridge Electric Lighting Co., Ltd. (jointly with the Notting Hill Electric Lighting Co., Ltd.).—Particulars filed of £150,000 debentures authorised January 11th, 1924, charged on freehold land near Wood Lane, Hammersmith, with the generating station thereon, the amount of the present issue being £100,000.

Satisfaction in full on February 19th, 1924, of debenture stock dated September 29th, 1908, securing £50,000.

Fladbury Electric Light & Power Co., Ltd. (63,942).—Return dated December 31st, 1923. Capital, £2,000 in £1 shares. 855 shares taken up. £855 paid. Mortgages and charges, £300.

Bullers, Ltd. (62,020).—Return dated January 11th, 1924. Capital, £400,000 in 20,000 ordinary and 20,000 preference shares of £10 each. 15,500 ordinary and 15,000 preference shares taken up. £150,070 paid on 7 ordinary and 15,000 preference shares. £154,930 considered as paid on 15,493 ordinary shares. Mortgages and charges, £235,250.

Tubes, Ltd. (91,224).—Return dated November 13th, 1923. Capital, £150,000 in £1 shares. All shares taken up. £1 per share called up on 82,859 and 10s. per share on 49,450 shares. £107,584 paid. £82,416 considered as paid, being £1 per share on 17,691 and 10s. per share on 49,450 shares. Mortgages and charges, nil.

H. Arrowsmith & Co., Ltd.—H. Sharp, of 30, Brown Street, Manchester, ceased to act as receiver or manager on February 26th, 1924.

Delagoa Bay Development Corporation, Ltd. (76,099).—Return dated December 26th, 1923. Capital, £160,300 in 267,400 ordinary shares of 10s. each and 65,300 preference shares of 5s. each. All shares taken up. £105,045 paid on 177,400 ordinary and 65,300 preference shares. £45,000 considered as paid on 90,000 ordinary shares. Mortgages and charges, £254,400.

Hewittic Electric Co., Ltd. (89,947). (Formerly Westinghouse Cooper Hewitt Co., Ltd.).—Return dated December 28th, 1923. Capital, £40,000 in £1 shares. All shares taken up. £30,000 paid. Mortgages and charges, nil.

Cape Electric Tramways, Ltd. (54,636).—Return dated December 5th, 1923. Capital, £500,000 in £1 shares. 491,222 shares taken up. £91,222 paid. £400,000 considered as paid. Mortgages and charges, £184,900.

City Notes.

Telegraph Construction and Maintenance Co., Ltd.

The Earl of Selborne K.G., presided over the annual meeting on February 13th, and in moving the adoption of the report (*vide* ELECTRICAL REVIEW, March 14th, p. 427), said that the company was still making good progress. The dividend they were paying, namely, ten per cent. free of income tax, was a good sound return and should be quite satisfactory to the shareholders. It was largely due to the financial policy which the directors had adhered to for the last sixty years that they had so long been able to distribute such satisfactory dividends. Competition had been very severe during the last year, and profits had been entirely sacrificed in many cases in order to keep factories going. They recognised that in the coming year it would not be less so—but their interest lay in the direction of reducing the cost of cables to the lowest possible figure, not only on account of English competition, but in

order that other countries might realise that the company's prices left nothing to encourage them to install factories for making their own cables. They had made a careful study of every means of increasing the efficiency of production and lessening the cost of manufacture. For many years the directors had had before them the importance of assuring to the company a definite supply of the finest gutta-percha at as low a cost as possible, and in 1913, therefore, they selected a suitable locality for starting a gutta-percha plantation in the State of Pahang, Federated Malay States, a district where the best gum was known to have been obtained in former years. The importance of establishing this new plantation industry was recognised by the Government of the Federated Malay States, which granted them the land on favourable terms, and the work of cutting down and clearing the jungle on the estate, preparing the nurseries, sowing the seed, and getting the land under cultivation was at once commenced. In July, 1915, for greater convenience they formed this enterprise into a subsidiary company called the Selborne Plantation Company, Limited, the whole of the capital being held by the company, and the directorate being the same and without remuneration. The Selborne Plantation Company had erected a complete factory on the estate with good quarters for the staff and workers, now numbering over five hundred, a hospital and a wharf on the river, with good roads. A railway station had been opened on the main line from Singapore opposite the estate. He was confident that the shareholders would recognise that the board was wise and prudent to make the company independent of a supply of wild gutta-percha, the continuance of which was by no means assured to them or anyone else. This country, and indeed the world in general, had been passing through the most acute financial crisis recorded in history, the results of which were written large in the terrible figures of the numbers of unemployed and in the reports of many companies which had had to pass their dividends. The cable companies of the world, both East and West, were in the hands of some of the most competent and far-seeing men of business that existed, and he thought it was a wonderful testimony to their confidence in the future and their courage in preparing for it, that in this time of great depression they had not hesitated to add fresh cables to those already existing. They had had their share of those orders and it was because of that that they had been able to maintain employment for their workpeople and dividends for their shareholders. Mr. Colin F. Campbell seconded the motion, which was carried unanimously.

Midland Counties Electric Supply Co., Ltd.

The annual meeting was held recently under the chairmanship of Viscount Chilston, G.B.E. In presenting the report and accounts, the chairman said that the past year had been marked by continued expansion. Although the traction undertakings had suffered during the year, owing principally to motor omnibus competition, the electric light and power undertakings had made great strides. An addition of 42 miles had been made to the h.p. cables, and the whole of the supply system of the Derbyshire and Nottinghamshire Company had been changed over from 25 to 50 cycles, without inconvenience to consumers. The electricity companies had sold 31,778,000 kWh as compared with 23,806,000 kWh in 1922, and the total load rose from 31,000 to 37,000 kW. The returns for the first month of the current year showed great progress. Orders had been granted to the company in respect of Coalville, Ashby-de-la-Zouch and district, and Matlock and district; an application for an order in respect of Sutton-in-Ashfield and district would probably be the subject of a local inquiry owing to a subsequent application made by the Mansfield Corporation. During the year an additional 3,000-kW turbo-alternator had been installed at the Hinckley station of the Leicestershire and Warwickshire Power Company, and orders had been placed for a 6,000-kW set for the same company's Avon station, and for a 12,000-kW set for the Spondon station of the Derbyshire and Nottinghamshire Company. The purchase of the Ilkeston property was completed during the year. The authorised share capital had been increased from £1,000,000 to £2,000,000 by the creation of 1,000,000 six per cent. cumulative preference shares; 750,000 of these had been issued, and the balance would be put forward at the first favourable opportunity. In connection with the purchase of the Spondon generating station 225,000 ordinary shares had been issued. The 5 per cent. debenture stock had been reduced by a further £5,650, and the £400,000 7½ per cent. mortgage debenture stock had been redeemed out of the preference issue. The chairman then briefly dealt with the accounts, which were abstracted in our issue of February 29th, p. 346, and the report was adopted.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The profit for the year 1923 was £619,666. Against this has been charged interest on debenture stocks, loans, &c., £177,921; transfer to reserve for special depreciation and contingencies, other than equalisation of dividends, £130,000; and transfer to reserve for plant renewals and improvements, £40,000, leaving £271,745, to which is added £18,541 brought forward, making £290,286. It is proposed to allocate this in the following manner:—Dividend of 3½ per cent. on the 7 per cent. on the cumulative preference shares (making 7 per cent. for the year), £105,000; dividend of 2½ per cent. on the 5 per cent. preference shares (making 5 per cent. for the year), £74,983; dividend of 6 per cent. on the ordinary shares, £77,861; carrying forward £32,442. The connections increased from 527,893 h.p. to 569,165 h.p. The expenditure on plant renewals and improvements during the year amounted to £37,304, and the additional capital expenditure upon works was £218,580. After the annual meeting, on March 25th, an extraordinary meeting will be held for the purpose of considering, and, if thought fit, adopting new articles of association.

Egham & Staines Electricity Co., Ltd.

Mr. Samuel Spencer (chairman) presided at the annual meeting on March 13th. Mr. W. A. Scott, F.C.A., J.P., joint managing director, in seconding the adoption of the directors' report and accounts, said that the demand for the supply of electricity had exceeded anticipations, and it was found necessary to apply for powers, which had been granted, to supply the neighbouring parishes of Feltham and Sunbury. Although the plant at the power station in Egham had been augmented to cope with this increased demand, still further generating plant would be required. The directors had applied to the Electricity Commissioners for leave to install two sets of about 2,000 h.p. each, but were directed to endeavour to obtain a supply in bulk from the Metropolitan Electric Supply Co. Negotiations were accordingly entered into with the Metropolitan Co., and an agreement ultimately arranged under which the company would receive an unlimited supply on very favourable terms. It was expected that the bulk supply would be available in the course of a few weeks. The sale of current had increased more than 55 per cent. over that of 1922, and the net profit from £8,296 to £10,365. The Trade Facilities Act Committee had agreed to advance a further £30,000 in respect of those extensions to which the company was already committed, and to meet the further outlay a public issue of share capital would shortly be made.

City of London Electric Lighting Co., Ltd.

The net addition to capital account during the year was £182,090, making the total net expenditure £2,783,072 (£873,424 written off). The balance available for distribution is £162,632; interim dividends absorbed £49,200, and it is proposed to deal with the balance (£113,432) as follows:—Final dividend of 7.2d. per share on the first preference shares (making 6 per cent. for the year), £9,225; final dividend of 9.6d. per share on the second preference shares (making 8 per cent. for the year), £9,225; and a final dividend of 2s. per share on the ordinary shares (making 15 per cent.), £61,500; leaving a balance of £33,482 to be carried forward.

Reference is made in the report to the draft scheme for the London and Home Counties Electricity District issued by the Electricity Commissioners and to the negotiations between the London supply companies and the London County Council. The terms of the London Electricity Supply (No. 1) Bill were approved at an extraordinary meeting on February 12th.

The new generating machinery, &c., was in service during the year. Offices have been erected over the new sub-station in Aldersgate and the registered offices of the company will be moved to that address.

The Aldersgate sub-station will serve the western portion of the City district and another similar sub-station will be provided for the service of the eastern portion.

A showroom and electric restaurant have been opened at King Street, Cheapside, for the convenience of consumers and others.

The report says that the company's charges have been severely criticised. This comes chiefly from the consumer who uses little artificial light and is charged on the higher scale. The company maintains that its method of charging according to the use made of the lamps is strictly fair to all classes of consumers. The average price per kWh for 1923 was 3.49d.; in 1922 it was 4.05d. Until the questions of the sliding scale and the application of the City Corporation to the Electricity Commissioners are settled no reductions in charges can be announced. Meeting: March 26th.

Chelsea Electricity Supply Co., Ltd.

The report of the directors for 1923, presented at yesterday's annual meeting, records a profit of £60,005, to which is added £4,695 brought forward and £3,257 for interest, making a total of £67,957. From this the following have been deducted:—Interest on debenture stock, £4,260; interim dividend at the rate of 6 per cent. per annum on the preference shares, £900; and an interim dividend at the rate of 9 per cent. on the ordinary shares, £11,123, leaving £51,674. It was recommended that this be appropriated as follows:—To reserve for renewals, depreciation, and contingencies, £17,000; to reserve fund, £10,000; final dividend on preference shares, making 6 per cent. for the year, £900; final dividend on ordinary shares at the rate of 18 per cent., making 12 per cent. for the year, £18,539; leaving £5,235 to be carried forward. The steam-driven plant has now been entirely dismantled, and energy is taken from the Central Electric Supply Co., with the exception of that portion generated by the company's own Diesel plant. A reduction in the maximum price of current was made during the year, and a further reduction is to be made as from the end of the current quarter. The connected load increased by 402 kW to 11,512 kW, and the energy sold by 464,321 kWh to 5,732,741 kWh.

Bristol Tramways and Carriage Co., Ltd.

The revenue for 1923 was £921,841, and the expenditure £838,848, making the net revenue, plus the amount brought forward; £84,251. Of this amount mortgage debenture interest absorbs £26,366; dividend on 4 per cent. preference shares, £15,375; and interim dividend at the rate of 3 per cent. on the ordinary shares, £20,016, leaving £22,494. A final dividend on the ordinary shares at the rate of 3 per cent. (making 6 per cent. for the year) is recommended, carrying forward £2,150. The reserve fund amounts to £341,461. The tramway department receipts showed an increase of £493, while those of the carriage department decreased by £2,757. The number of passengers carried increased from 75,891,312 to 82,745,228. The meeting was held yesterday (Thursday).

South London Electric Supply Corporation, Ltd.

The net total capital expenditure was increased by £28,945 during 1923, making it £565,062. The balance to the credit of the revenue account, after the deduction of expenses, amounted to £103,300. To this were added £9,609 brought forward, and sundry receipts amounting to £4,055, giving an available total of £116,964. Interest on first mortgage debenture stock, temporary loans, and consumers' deposits absorbed £6,504; £15,000 is transferred to the depreciation reserve; and £40,000 to general reserve, leaving £55,460 for distribution. Interim dividends required £11,300, and it is proposed to deal with the balance of £44,160 as follows:—A final dividend at 3 per cent. on the 6 per cent. fully-paid cumulative preference shares; and a final dividend on the ordinary shares at 8 per cent. (making 12 per cent. for the year), together with a bonus of 3 per cent.; £14,660 to be carried forward. The amount of energy sold increased from 10,532,615 kWh to 12,028,137 kW, and the applications for energy from 21,851 kW to 22,966 kW. The meeting is to be held on March 27th.

Brompton and Kensington Electricity Supply Co., Ltd.

The revenue account for 1923 shows a credit balance of £52,873, which, together with £7,589 brought forward and £114 interest, makes a total of £60,576. Interim dividends on the preference and ordinary shares absorbed £14,865, and £138 was written off cost of investment, leaving £45,576. This it is proposed to deal with as follows:—To depreciation account, £12,246 (making it £100,000); to reserve fund account, £10,000; final dividend on preference shares, £289; final dividend at the rate of 10 per cent. per annum, free of tax, on the ordinary shares (making 10 per cent. for the year), £14,587; leaving £8,454 to be carried forward. The 35-W lamp equivalent of connected load rose from 521,834 to 539,519; the average price obtained per kWh fell from 5.28d. to 5.09d. The meeting was held yesterday.

British Insulated and Helsby Cables, Ltd.

The report for 1923, which is to be presented at the annual meeting on March 24th, shows that the profit, after making provision for estimated liability for Corporation profits tax, amounted to £347,695. To this is added £391,675 brought forward, making £739,371. Directors' fees, &c., absorb £8,998; interest on first debenture stock, £22,500; interest on second debenture stock, £10,000; dividend on preference shares, £30,000; and interim dividend on ordinary shares, £50,000. Of the balance, £617,873, £50,000 is allocated to depreciation; £50,000 to reserve account; and £5,000 to first mortgage debenture stock redemption account, leaving £512,873. The directors recommend a final dividend of 5 per cent. on the ordinary shares, together with a bonus of 5 per cent., making 15 per cent. for the year, and the carrying forward of £412,873. During the year the company experienced a substantial increase in turnover, and although the rate of profit was smaller the results are considered satisfactory.

Electro Bleach and By-Products, Ltd.

The report for 1923 shows that the profit, after deducting repairs, standing charges, depreciation, directors' additional remuneration, and bonus to employés, and making reserves for taxation, amounted to £52,047, to which was added £1,244 brought forward, making £53,291. After charging the interim dividends of 3½ per cent. on the preference shares, and 7 per cent. on the ordinary shares, there is an available balance of £39,291. The directors recommend final dividends of 6½ per cent. on the preference shares (making 10 per cent. for the year), and of 13 per cent. on the ordinary shares (making 20 per cent. for the year), which will absorb £26,000. £10,000 is to be transferred to the reserve account, and £3,291 carried forward.

Crossley Bros., Ltd.

Against a profit of £13,080 for 1923 has been set a loss of £102,137 in respect of investments which have become valueless. In addition, a debtor balance of £120 448 is brought forward, making a total debit of £209,504. To meet this and to place the company on a sound basis it is proposed to write down the value of the £1 ordinary shares by one-half, and to write off the arrears of dividend on the preference shares. To compensate preference shareholders it is intended to increase the dividend from 5 to 7 per cent. The properties of the company are valued at £712,206.

Newcastle and District Electric Lighting Co., Ltd.

The annual meeting was held on March 14th, Col. Frank R. Simpson in the chair. The chairman, in moving the adoption of the report (see our last issue, p. 425), said that the second debenture redemption fund now stood at £32,010, and was equivalent to making a further provision for depreciation in addition to the amount already written off. The capital expenditure during the year, £18,246, included an amount of £14,000 for mains laid to meet the requirements of new consumers. The total receipts showed an increase of £13,546, or 12 per cent., while the increase in the total costs was only £2,738, or 4 per cent., being due in a large measure to more economical plant. The increase in the gross profit was £10,809, which was a very satisfactory result. Electrical energy for power purposes showed an increase of 20 per cent., lighting 8 per cent., and heating 12 per cent., the last having recently been in great demand. Judging by the results from January to date, this year, he thought the shareholders might look forward to a continuance of last year's progress. An extraordinary meeting, held immediately after the annual meeting, decided that each of the existing £10 shares of the company should be divided into ten shares of £1 each.

Woking Electric Supply Co., Ltd.

After writing down sundry items there remained a balance on the year's working of £27,905; to this is added £1,317 brought forward, making £29,222. The payment of interest on debenture stock and temporary loans, dividends on preference shares, and income tax absorbed £8,574, leaving a disposable balance of £20,648. It is proposed to allocate this as follows:—To depreciation and renewals fund, £8,000; to reserve account, £8,000; dividend on the ordinary shares at the rate of 10 per cent. (free of tax), £2,722; leaving £1,926 to be carried forward. The number of lamps connected rose from 222,590 to 238,573, and the revenue from £47,562 to £49,268.

Vickers, Ltd.

At the general meeting of the holders of the company's 4 per cent. first mortgage debenture stock, on Friday last, the proposals outlined in our issue of March 7th. (p. 388) were put forward and approved. As a consequence it was announced that an issue of £2,000,000 5½ per cent. first mortgage debenture stock would be made during the present week. The holders of the 7 per cent. seven-year notes will be entitled to the preferential allotment of the new stock equal in amount to the nominal value of the notes surrendered. In the alternative these notes are redeemable at par on July 1st.

Waste Heat and Gas Electrical Generating Stations, Ltd.

The annual meeting of this company, whose report was reviewed in our last issue (p. 425), was held on March 13th, Mr. F. Stirling Newall presiding. The chairman said that the accounts were very satisfactory. The total instalments received under the agreement with the Newcastle-on-Tyne Electric Supply Co. in respect of the purchase of stations had been £17,766, the same as last year, so that the net balance of capital expenditure outstanding was £241,472, as against £254,566 last year. The increase of £4,580 in the profit had been due to two causes:—First, the increased output from the stations and also from the increased dividend which they had received from their investment in the ordinary shares of the Bankfoot Power Co., Ltd.

Windsor Electrical Installation Co., Ltd.

The profit for 1923 was £16,306 (including £2,576 brought forward). This is to be disposed of as follows:—Debenture and other interest, £441; dividend on 5 per per cent. preference shares, £904; to depreciation, renewal, and reserve fund, £4,000; to depreciation of free-wiring and motors on loan, £1,000; to special reserve fund, £2,500; directors' fees and tax, £710; dividend of 10 per cent. on the ordinary shares, £3,844; carried forward, £2,907. The capital expenditure was increased to £104,964 by the purchase of a Diesel engine and a rotary converter. The charge for energy is to be reduced by 1d. per kWh after the present quarter.

Slough and Datchet Electric Supply Co., Ltd.

The accounts for 1923 record a profit (including £3,572 brought forward), of £18,131. The depreciation, renewal, and reserve fund receives £4,500; depreciation of free-wiring and motors on loan absorbs £1,000; £3,000 is allocated to the general reserve fund; directors' fees require £550; and the tax on these fees amounts to £160, leaving a balance of £8,921. A dividend of 10 per cent. less tax, is recommended, a balance of £4,308 being carried forward. The capital expenditure was increased during the year by £7,144 to £120,977. The amount of energy sold rose from 2,306,595 to 2,842,280 kWh.

German Companies.

The *Electric Light and Power Investment Company*, of Berlin, having regard to the general conditions and the impending change over to gold accountancy, proposes to carry forward the net profits for the past financial year.

The *Transradio Company for Oversea Communications*, of Berlin, reports that traffic at the Nauen station and at the Eilvese station, which is partly owned by the company, was

maintained in 1923 at the level of that in the previous year. Favourable development took place in the connection with Egypt, and the station established at Hamburg, with a transmitter to Eilvese, was utilised largely and effected a considerable reduction in the time of transmission for oversea telegrams from Hamburg and Bremen. The report also refers to the international wireless programme, which would result in the company having a further source of income. It is not proposed to make any distribution for the past year out of the paper profits of 129.68 billions of marks.

The *A.E.G. Undertakings Company*, of Berlin, has set aside for taxes the net profits for 1922-23, this comparing with a dividend at the rate of 6 per cent. in the previous year.

The *Elektra Electrotechnical Company*, of Essen, records net profits of 29.34 millions of marks for 1922-23, which sum has been partly transferred to the reserve fund and partly carried forward.

The *Telephone Works Company* (late J. Berliner), of Hanover, reports that the turnover and the number of workers employed in 1922-23 reached unprecedented figures. All departments were well occupied, but the considerable net profits melted away to nothing through the depreciation in the second half of the year. After having made provision for depreciation, the balance remaining has been carried forward. The stagnation which took place in business towards the end of 1923 is said to have now given way to more activity.

French Companies.

Société Nantaise d'Eclairage et de Force par l'Electricite.—The capital of this company is to be raised from 40,000,000 to 80,000,000 fr. by the issue of 160,000 250-fr. shares. The increase is necessary owing to the demand. The revenue is steadily advancing. For the first eleven months of 1923 it was 17,383,000 fr., or a 43 per cent. advance on that of 1922. The district of Nantes, both on account of its port and its industries, is rapidly developing; hence the need for adding a second 10,000-kW set and for studying other means of increasing the production of energy. Furthermore, the electrification of the whole of the Department of the Loire Inférieure, which will probably be shortly decided upon by the Conseil Général, will demand an increase in the company's finances. The Board resolved on the immediate issue of a first instalment of 20,000,000 fr. or 80,000 250-fr. shares at par.

Etablissements Paul Gadot.—The accounts show a credit balance for the year 1922-3 of 154,895 fr., which has been apportioned to various sinking funds. The acquisitions of certain assets of the Innovation and the Etincelle companies, involving an increase of 250,000 fr. in the company's capital, has been sanctioned.

Forces Motrices du Vercors.—Capital increased from 7,000,000 to 9,500,000 fr. by the issue, at 550 fr. of 5,000 500-fr. shares.

Société Anonyme d'Eclairage et de Applications Electriques.—The dividend for 1922-23 is 12.50 fr. per share.

Société de Distribution de l'Electricité de l'Ouest has increased its capital to 15,000,000 fr.

The Secteur Electrique du Nord de la Gironde has raised its capital from 3 to 5,000,000 fr. by the issue, at par, of 8,000 250-fr. shares.

The *Société pour L'Equipement Electrique des Vehicules*, of Issy (Seine), reports net profits of 899,000 fr. for 1923 as compared with 473,000 fr. in the preceding year, and a dividend at the rate of 30 fr. gross has been declared as against 25 fr. in 1922. The turnover last year increased by 33 per cent. and a further increase has taken place in the first months of the new financial year. It was impossible fully to meet the demands made upon the company last year owing to the lack of new equipment, and it is now proposed to raise the share capital by 3,000,000 fr. to 12,000,000 fr. in order to provide the new plant for the extension of the business.

The *Société Centrale pour L'Industrie Electrique*, of Paris, reports net profits of 2,439,000 fr. for 1923 and the rate of dividend has been increased from 6 per cent. in 1922 to 7 per cent. last year. According to the report, approved at the recent meeting, the company participated in 1923 in the increases of capital undertaken by various concerns, including the French Thomson-Houston Company, and satisfactory information had been received from Russia respecting the Russian Electric Power Company. In the course of his speech to the shareholders the chairman referred to the great work which had been accomplished in the restoration of the country, which could now devote itself to the development of agriculture, industry and economic equipment, together with the utilisation of colonial resources, and he remarked that the use of electrical power would not fail to find a large place in the execution of this vast programme, which would afford opportunities for the company to render assistance to the industries concerned.

The French Cable Company.

At the recent meeting of the Compagnie Francaise des Cables Télégraphiques the directors reported that the subsidy granted by two Australian States for the cable between Australia and New Caledonia for a period of 30 years had expired, and as it had not been renewed the company had entered into negotiations with the French Government with a view to securing the financial co-operation of the latter in the matter of this cable, the working of which was not remunerative. If these negotiations should not be successful the directors proposed to dispose of the cable, and this intention was approved by the meeting. At the same time the shareholders sanctioned the sale to the All-America Cables Company of the company's cable lines in the West Indies for a sum ranging from 2,235,000 to 2,735,000 dollars, according to the rate of exchange. On the other hand the American company has undertaken to transmit to the French company in New York a certain amount of traffic for dispatch along the latter's cables until the end of 1940.

Allmanna Svenska Elektriska A.B.

The annual report states that the sale of electrical manufactures was somewhat greater in 1923 than in the preceding year and yielded better economic results, the increased turnover having rendered necessary an increase in the number of workmen. Among the orders received during the year are mentioned a contract for the equipment for 50 electric locomotives for the Stockholm-Gothenburg railway, each of 1,500 h.p., as well as for five converter stations, with machines, transformers and apparatus. Substantial orders for export came to hand. Among others an order was booked for Canada for the delivery of power station equipment consisting of two three-phase generators, each of 10,000 kW, together with transformers and apparatus. Some large contracts were received from Spain, while the Soviet authorities ordered four vertical three-phase generators for the Volkhov station. At the close of 1923 the company employed 5,201 persons in the offices and works in Sweden. The financial results for 1923 were recorded in our issue of February 22nd.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Yorkshire Electric Power Co.—255,000 ordinary shares of £1 each, fully paid, Nos. 830,001 to 1,085,000.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Scottish Power Co.—90,000 ordinary shares of £1 each, fully paid, Nos. 160,001 to 250,000.

Charing Cross Electricity Supply Co.—96,000 ordinary shares of £1 each, fully paid, Nos. 480,001 to 576,000.

Electrical Distribution of Yorkshire.—100,000 new ordinary shares of £1 each, issued at 25s. per share, partly paid and fully paid, Nos. 150,001 to 250,000.

Llanelly and District Electric Lighting and Traction Co.—65,000 ordinary shares of £1 each, fully paid, Nos. 285,001 to 350,000; and 50,000 six per cent. cumulative preference shares of £1 each, fully paid, Nos. 400,001 to 450,000.

Applications have been made to the Committee to allow the following to be officially quoted:—

Clyde Valley Electrical Power Co.—60,000 ordinary shares of £10 each, fully paid, Nos. 1 to 60,000; 30,000 6 per cent. cumulative preference shares of £10 each, fully paid, Nos. 1 to 30,000; and 50,000 8 per cent. cumulative second preference shares of £10 each, fully paid, Nos. 1 to 50,000.

Scottish Power Co.—250,000 ordinary shares of £1 each, fully paid, Nos. 1 to 250,000, and 250,000 8 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 250,000.

Singapore Electric Tramways, Ltd.—By an order of Mr. Justice Romer, in the High Court Chancery Division, it was directed that separate meetings of the holders of the mortgage debentures, the unsecured creditors of the company (other than creditors in Singapore), and the holders of shares in the company's capital respectively be convened, and, if thought fit, approve a scheme of arrangement proposed to be made. The meetings were to be held at Winchester House, Old Broad Street, on March 20th.

Direct Spanish Telegraph Co., Ltd.—The report for 1923 shows that the available balance, after providing for income and corporation profits taxes, and interest on loans, and including the balance brought forward, was £17,097. The directors propose to deal with this as follows:—Dividend on preference shares of 10 per cent., £3,000; dividend on ordinary shares of 10 per cent., free of tax, £6,465; to reserve fund, £5,000; carrying forward £2,632. The company's cables have continued to work well during the year under review.

Costa Rica Electric Light and Traction Co., Ltd.—The net earnings in Costa Rica during 1923 amounted to £23,243, an increase of £1,245, notwithstanding the further depreciation of the colon. The net profit was £3,739 (as against £2,495) and to this is added £5,189 brought forward, making £8,869, which it is proposed to carry forward. The operation of the sinking fund for the 6 per cent. prior lien debentures was resumed in May last, when debentures of the nominal amount of £1,400 were redeemed.

Davis & Timmins, Ltd.—The accounts presented at the annual meeting, on March 13th, showed a net profit of £19,566, and, with the balance brought forward, there was an available sum of £48,751. A final dividend at the rate of 10 per cent., free of tax (making 8 per cent. for the year) is being paid on the ordinary shares, together with a bonus of 17 per cent., free of tax. A balance of £29,517 is carried forward.

British L. M. Ericsson Manufacturing Co., Ltd.—The net profit for 1923 was £28,302 (as against £10,681 in the previous year). To this was added £43,157 brought forward, making available £71,458. A dividend of 10 per cent., free of tax, on the ordinary shares (as compared with 8 per cent.) is recommended, and it is proposed to transfer £10,000 to reserve, £10,000 to a special reserve for contingencies, and to carry forward £35,458. Meeting: March 27th.

Pacific Gas and Electric Co.—The gross earnings for 1923 was $39,971,742, and the net income $16,478,332. After paying bond interest, &c., and making provision for depreciation, there remains a balance of $6,756,294, out of which it is proposed to pay the dividend on the preferred stock, and 8 per cent. on the common stock (as against 7½ per cent. in 1922).

Pritchett & Gold and E.P.S. Co., Ltd.—The report for 1923 records a profit of £33,798, out of which it is proposed to transfer £5,000 to depreciation reserve, £3,000 to plant depreciation, to pay a dividend of 12½ per cent., free of tax, on the ordinary shares, and to carry forward £36,009 (subject to income and corporation profits taxes). A considerable interest has been taken up in Batteries, Ltd., of Redditch.

Pinchin, Johnson & Co.—At the annual meeting on March 12th, the chairman (Mr. E. Robson) forecast still further prosperity for the company. The business of Wilkinson, Heywood & Clark, Ltd., had been merged in the Pinchin, Johnson organisation, and this would add materially to the value of that company.

W. Canning & Co., Ltd.—The profit for 1923 was £35,229, and, with the balance brought forward, a total of £37,638 was available. It was proposed to distribute this as follows:—Dividend of 10 per cent., less tax, on the ordinary shares, £23,062; reserve fund, £10,000; employés' benevolent trust fund, £1,000; carrying forward £3,576. The meeting was held on the 17th.

Swiss Company.—A scheme of reconstruction is about to be submitted to the shareholders by the directors of the Société des Usines Electriques de la Lonza, of Basel. The existing ordinary share capital of 24 million fr. is to be written down to 9 millions, and then increased to 16 millions by the issue of new shares. It is also intended to issue 19 millions in 7 per cent. preference shares.

Cammell, Laird & Co., Ltd.—The profit for 1923 was £70,053. A balance of £38,015 is carried forward after paying a final dividend on the preference shares (making 5 per cent. for the year). No dividend is to be paid on the ordinary shares; for 1922 the dividend was 5 per cent.

Midland Electric Corporation for Power Distribution, Ltd.—The directors recommend a dividend of 10 per cent. and a bonus of 2½ per cent. (making 12½ per cent. for the year).

International Automatic Telephone Co., Ltd.—Dividend on 7 per cent. cumulative preference shares, less tax, payable April 1st.

Stocks and Shares.

MONDAY EVENING.

WITH this week there ends for all practical purposes the Stock Exchange financial year, the settlement of March 20th making the last of the series for 1923-24. A good deal of re-arrangement takes place in the world of domestic Stock Exchange politics at this season, but upon the present occasion, such alterations have no direct bearing upon any of the markets. Business is fairly well maintained. There is a good demand for better-class stocks and shares, new issues having no difficulty in obtaining support when they have anything attractive to offer. There is plenty of money about and available for investment, a factor which emphasises the impression that trade revival in the principal industries must of necessity be slow. The rally in the French rate of exchange is a favourable factor neutralised, however, to a large extent by the fears of strikes at home.

The Home Railway companies have issued their reports and held their meetings. Consequently there is nothing, in Stock Exchange parlance, for people to go for, and with the crop of labour troubles industriously growing, no special attraction appeals from Home Railway stocks. The result is that prices are stagnant. Metropolitans are ¼ lower at 75, and Districts down 30s. at 52, in spite of Exhibition talk. The substantial rises in Central London non-assented stocks, ranging from 8 to 15 points, to which attention was drawn last week, have been held. It is taken for granted that proprietors of the stocks will gladly accept the offer which is now held out to them for conversion of their securities into the Assented group.

With the announcement of the date for opening the British Empire Exhibition, interest is given a further fillip in shares likely to be benefited. So far as can be seen, there are all the elements, in the Exhibition, for a triumphant success or a melancholy fiasco. Doubtless the weather will have a good deal to do with the issue. Some men think that the advertisement of fancy prices said to have been paid for hotel accommodation, flats, &c., will have the effect of keeping people away. The business man feels that unless the Exhibition is practically complete when it is opened, there will be a bad impression created upon the minds of Londoners, who, after all, will be amongst the principal supporters of the gathering. The electricity companies, supply and manufacturing alike, are expected to secure an extremely valuable advertisement from the incidence of the Great Fair.

Charing Cross ordinary rose 1s. 6d. to 46s. 6d. County and City of Londons are better at the common price of 49s. 6d. Westminsters regained a little more of the recently deducted dividend, and at 10⅝ are ¼ up. Metropolitans rose to 1 13/16, Londons to 4½, South Metropolitan preference improved to 24s. 6d.; Whitehall preference are once more £1. The City of London report shows that, although the dividend is maintained at 15 per cent., the sales of current went down a little, which was compensated by saving in expenditure. The net profit of £162,000 is about £8,000 better than that for last year. The report contains a protest from the board at the manner in which the company's tariff has been criticised for being too high. Whitehall 7½ per cent. preference put on 1s. at 20s. 6d.

Cable stocks have scarcely moved. Anglo-American preferred is down a point to 102, there being a fairly large deceased account, it is said, now in course of realisation. Possibly, however, another reason may be found in the fact that the deferred stock pays nearly 1 per cent. more on the money than the preferred, and the difference in the security scarcely warrants so much margin between the two. Oriental Telephones are ¼ lower at 1¾, and Chile Telephones lost 2s. 6d. of their big rise of last week, the price easing off to 6¼. Venezuelan Telephones are a little lower at 12s. 6d.

The Marconi group is inclined to lean to the lower side, though no particular change has occurred in quotations. Radios, both ordinary and preferred, are heavy at about 18s. 6d. Marconi, the parent shares, can be bought at 35s. The new developments which are being advertised in the world of broadcasting every week, profoundly interesting as they are, have no effect in leading people to buy Marconi shares.

The market for manufacturing shares is good. There are rises in Henleys, Callenders, General Electric ordinary, and a few others. British Aluminium retain their advance at 22s. 6d. No change has occurred in British Insulated Cables at 2¼. The company's net profit of £256,000 is about £8,000 less than that of a year ago, but depreciation has benefited to the extent of £10,000, and the reserve fund is raised to £350,000. Some little disappointment is felt with the retention of the dividend of 15 per cent., owing to the fact that the interim was raised from 3¾ to 5 per cent., which means, of course, that the final is lowered from 11¼ to 10 per cent. Brush Electric are fairly active round 26s. 6d. Babcock and Wilcox went back to 46s. 3d., and iron and steel shares generally are heavy, in consequence of the fear of a miners' strike.

London United Tramways debenture at 51¼ is down 2½ points, and this list as a whole is disposed to droop. London and Suburban Traction 4½ per cent. first mortgage debenture at 61½ has fallen 2 points. Metropolitan Electric Tramways 4½ per cent. debenture at 80½ is also lower, this stock being depressed by the new London General Omnibus issue that is coming during the present week. Brazilian Tractions maintain their price, in spite of the fact that the milreis has gone back from its recent best. Anglo-Argentine Tramway debentures are not quite so good, and the Mexican list is almost stationary. Rubber shares weakened, in consequence of the further fall in the price of the raw material to a trifle under 1s. per lb.

Of the ordinary shares listed in our tables, it may be of service to mention that there is now a rather more liberal supply than is usual in these tightly-held investments. For example, the market is now offering 1,000 shares each of Bromptons, Charing Cross, County and Metropolitan. There are obtainable, amongst others, 100 Kensingtons, 250 St. James', 500 London Electrics, 200 Westminsters, with 1,000 Newcastle-on-Tyne, 1,000 South Londons, and 1,000 English Electrics. These are all ordinary shares. In addition, others which can now be secured are:—

Ordinary.	Price.	Yield.	1921.	1922.	1923.
Cawnpore (£1) ...	23/6	8½	10	10	6†
Clyde Valley (£10) ...	13¾	5¼	7½	8	8
East African (new) (£1)	19/6	8½	—	8	5†
Madras (£1) ...	23/0	7*	8*	8*	—
Melbourne (Stock) ...	149	6¼*	10*	10*	10*
Midland Counties (£1)	19/6	5¼	4	5	5¼

*Free of tax. †Interim: at rate of.

The yields, in the third column, are calculated upon the basis of the full dividend paid for the last completed year in each case.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1922.	Dividend. 1923.	Price Mar. 17. 1924.	Rise or fall.	Yield. p.c.
Brompton Ordinary	1	12	10	38/9	—	*£5 3 3
Charing Cross Ordinary	1	14	14½	42/6	+1/6	6 4 9
do. do. do. 4½ Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	10	12	38/9	—	6 8 0
City of London	1	15	15	49/6xd	+ 1/2	6 1 2
do. do. 6 % Pref. ...	1	6	6	23/-	—	5 4 4
County of London	1	10	15	49/6	+9d.	6 2 6
do. do. 6 % Pref. ...	1	6	6	23/3	—	5 3 3
Edmundson's Ordinary	3	7	7	4 1/4	—	5 3 4
do. 6 % Pref.	5	6	6	4¾	—	6 3 0
Kensington Ordinary	—	12	14	10½	—	6 13 4
London Electric	3	10	10	4¾	+ ¼	6 3 10
do. do. 6 % Pref. ...	5	6	6	5 1/2xd	— ¼	5 11 7
Metropolitan	1	8½	10	1 1/8	+ 1/8	5 11 4
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	2½	6	18/9	—	6 8 0
do. 5 % Pref. ...	1	5	5	16/3	—	6 3 1
do. 7 % Pref. ...	1	7	7	22/6	—	5 19 2
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	—	—	17/6	—	Nil.
do 6 % Pref. ...	1	5	5	17/6	—	6 17 2
St. James' and Pall Mall ...	5	14½	17½	12¾	—	6 17 3
South London	1	11	15	42/9	—	7 0 2
South Metropolitan Pref. ...	1	7	7	24/6	+9d.	5 14 3
Westminster Ordinary	5	12	15	10¾	+ ¼	7 1 2
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	20/6	+1/-	7 6 4

HOME RAILS.

Central London Ord. Assented	Stock	4	4	68½	—	5 16 10
Metropolitan	,,	3½	4	75xd	— ½	5 6 8
do. District	,,	3	3½	52	— 1½	6 14 7
Underground Electric Ordinary	10	Nil	Nil	2¾	—	Nil
do. do. "A" ...	1	Nil	Nil	8/-	—	Nil
do. do. Income Bonds	5	6	100	—		*6 0 0

TELEGRAPHS AND TELEPHONES.

		Dividend. 1921	Dividend. 1922			
Anglo-Am. Tel. Pref.	Stock	6	6	102	—1	5 17 9
do. Def.	,,	1½	34/6	22½	—	6 13 4
Chile Telephone	5	6	6	6¾	— ¼	4 18 0
Cuba Sub. Ord.	10	7	7	7½	—	9 13 2
Eastern Extension...	10	10	10	16¾	—	5 18 6
Eastern Tel. Ord.	Stock	10	10	168½	—	5 18 8
Globe Tel. and T. Ord. ...	10	10	10	17½	—	5 16 0
do. do. Pref.	10	6	6	10¼	—	5 10 4
Great Northern Tel.	10	24	22	28	—	7 16 9
Indo-European	25	10	7	32½	—	*5 7 8
Marconi	1	25	15	11¾	—	8 11 6
Oriental Telephone Ord.... ...	1	12	12	13/	— ¼	*6 17 2
United R. Plate Tel.	5	8	8	6¾	—	*5 16 6
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	16¾	—	6 0 1

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	12½	3 5/8	—	8 6 0
do. do. 2nd Pref. ...	5	Nil	5½	2 1/2	—	10 4 4
do. do. 5% Deb. ...	Stock	5	5	74½	— ½	6 14 3
British Electric Traction Ord. ...	,,	4½	5	72	—	6 19 0
do. do. 6% Pref. ...	,,	6	6	98½	—	6 1 10
Brazil Traction	100	Nil	4	59½	—	6 14 6
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	85	+ ½	5 17 8
do. do. Preferred	,,	5	90/-	85½	—1	*5 12 4
do. do. Deferred	,,	8	127/-	103	+ ½	*6 7 0
do. do. Deb.	,,	4½	4½	76½	—	5 11 1
Lond. & Sub. Trac. 5 % Pref. ...	1	8½	5	6/-	—	8 6 8
London United Tram. Deb. ...	Stock	4	4	51½	—2½	7 15 4
Mexico Trams. 5% Bonds ...	—	Nil	Nil	74	—	6 11 6
do. 6% Bonds ...	—	Nil	Nil	51½	—2	Nil
Mexican Light Common ...	100	Nil	Nil	23½	—	Nil
do. Pref.	100	Nil	Nil	48½	—	Nil
do. 1st Bonds ...	—	Nil	5	68½	—	7 6 0

MANUFACTURING COMPANIES.

Babcock & Wilcox...	1	15	20	46/3	—2d.	*4 6 8
British Aluminium Ord.... ...	1	10	5	22/6	—	4 8 10
British Insulated Ord.	1	15	15	2½	—	6 0 0
Callenders	1	15	15	48/9	+6d.	6 3 0
do. 6½ Pref....	1	6½	6½	23/9	—6d.	5 9 5
Crompton Ord.	1	10	5	½	—	10 0 0
Edison-Swan	4/-	10	Nil	4/9	—	6 6 4
do. ,, 5% Deb. ...	Stock	5	5	77½	—	6 9 0
Electric Construction	1	10	10	1 7/8	—	6 7 5
English Electric	1	8	5	17/9	—	5 12 3
do. do. Pref.	1	6	6	19/6	—6d.	6 3 1
Gen. Elec. Pref.	1	6½	6½	23/3	—	5 11 10
do. Ord.	1	10	5	20/9	+6d.	4 16 5
Henley	1	15	15	2 7/8	+ 1/8	6 3 0
do. 4½ Pref.	5	4½	4½	4¾	—	5 9 1
India-Rubber	1	10	10	¾	—	*6 13 4
Met.-Vickers Pref....	2	8	8	2 7/8	—	6 5 0
Siemens Ord.	1	10	10	17/3	—	Nil
Telegraph Con.	12	20	20	24½	—	*4 18 6

* Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price Mar. 18.	Fortnight's Inc. or dec.
a Acid, Oxalic	per lb.	5¾d.	...
a Ammoniac, Sal	per ton	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4¼d.	...
a ,, Perchlorate	,,	4¼d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ...	,,	£7 15s.	...
a ,, Roll	,,	£7 15s.	...
a Soda, Chlorate	per lb.	3d.	...
a ,, Crystals	per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ...	per lb.	4½d.	...
METALS, &c.			
b Aluminium, Ingots	per ton	£120 to £125	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net	£264	...
Grade II	,, ,,	£188	...
Grade III	,, ,,	£102	...
c Brass (rolled metal 2" to 12" basis)	per lb.	10¼d.	...
c ,, Tubes (solid drawn) ...	,,	1/0½d. to 1/0¾d.	...
c ,, Wire, basis	,,	10¾d.	...
c Copper Tubes (solid drawn) ...	,,	1/1¾d.	¼d. inc.
c ,, Bars (best selected) ...	per ton	£100	...
c ,, Sheet	,,	£100	...
c ,, Rod	,,	£100	...
d ,, (Electrolytic) Bars ...	,,	£73 10s.	10/- dec.
d ,, ,, Sheets ...	,,	£145 10s.	...
d ,, ,, Wire Rods ...	,,	£83 10s.	10/- dec.
d ,, ,, H.C. Wire	per lb.	10¼d.	¼d. dec.
f Ebonite Rod	,,	2/- to 3/6	...
f ,, Sheet	,,	2/- to 3/6	...
n German Silver Wire	,,	2/3	...
h Gutta-percha, fine	,,	8/6	...
h India-rubber, Para fine	,,	11¼d.	¼d. dec.
Iron Pig (Cleveland Warrants) ...	per ton.	£5 2s. to £5 2s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£35	...
g Lead, English Pig	,,	£36	6/- dec.
g Mercury	per bot.	£10 5s. to £10 10s.	12/6 to 15/- inc.
e Mica (in original cases) small ...	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large ...	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/3½	...
p ,, ,, drawn bars & rods	,,	1/4	...
p ,, ,, rolled strip & sheet	,,	1/3½	...
p ,, ,, wire	,,	1/4½	...
o Platinum	per oz.	£25	...
d Silicium Bronze Wire	per lb.	1/0½	...
r Steel, Magnet, in bars	,,	10d.	...
n Tin, Block (English)	per ton.	£254	£26 10s. to £27 dec.
n ,, Wire, Nos. 1 to 16	per lb.	4/2	...

*For 1 cwt. lots. Special quotations against definite specifications. Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

A Review of Electrical Development.—On March 10th, at the request of the British Electrical Development Association, Mr. C. H. Wordingham, C.B.E., delivered an address on "Electricity: A Social and Domestic Power," to a meeting of the British Women's Patriotic League. The address was, in effect, a review of the development of electricity in many directions, covering a wide field in a concise manner. Commencing with telegraphy and telephony, with their extensions to "wireless," the speaker touched upon traction, furnaces, steel mills, coal winders, &c. Special mention was made of the many applications of electric lighting, and then the speaker briefly explained the methods of production and distribution of electricity, stating that an endeavour was now being made to remove the handicaps under which electricity supply laboured in this country. The use of water power for generating electricity was mentioned, and Mr. Wordingham corrected a number of popular errors in this connection. A large part of the address was devoted to the domestic uses of electrical energy. The speaker emphasised the fact that electrical cooking was quite out of the experimental stage, and refuted the idea that the generation of electricity was wasteful of coal. The address concluded with an assurance that electricity was of real social value, and the fact that this was realised by the audience was demonstrated by the tone of the questions asked by members of the audience.

The Ideal Home Exhibition.—CORRECTION.—In the description of the Exhibition in our issue of March 7th we incorrectly applied the term "'laryngophone' type" to the throat transmitters exhibited by the Reliance Telephone Co., Ltd. The Telephone Manufacturing Co., Ltd., has written pointing out that the term "Laryngaphone" is that company's registered name for its instruments, and asking us to correct our statement; this we do with pleasure.

Mica and Micanite Insulation.—II.

Varieties, Properties, Practical Tests and Choice of Mica, and the Manufacture and Test of Commutator Micanite.

By ARCHIBALD A. C. DICKSON.

(*Concluded from page* 409.)

Mica for Washers.—Almost any flat-surface commercial quality mica of the muscovite or phlogopite groups will answer for this purpose, but it is usual to use the cheaper qualities of these two groups. In fact, in America and on the Continent a popularly-called "cross-grained" mica (a mica twinned between successive laminæ and not easy to split or exfoliate) is used for stamping into washers and then smoothing down on the lathe as it is so much cheaper to make and falls lightly on this class of cheap insulation expense. Incidentally, there are approximtely 15,000-20,000 tons of such mica lying on the waste dumps at the different mines in India alone, and it may be had cheap. This mica is good in every way for washers and other small solid natural mica stampings, but this quality is ignorantly condemned in this country just because it will not split freely.

Micanite.

Commutator Micanite.—Splittings made from phlogopite or amber mica are inferior to the splittings made from muscovites. The former, owing to its darker colour and the difficulty of splitting it very thin, is difficult to inspect quickly for grosser impurities along the cleavage planes, and owing to the twinning between successive laminæ the films have very uneven surfaces, which make the uniform thickness of the finished sheets of micanite questionable; therefore, it is considered the best practice to use No. 5 pan packed splittings for this class of micanite. The area of the slab No. 5 used for splitting is from 3 to 5½ sq. in. The mica itself is first cobbed and then knife trimmed, under which processes all rough and crystal edges are removed. Then the clean flat slab is split by means of a thin-bladed knife to ensure uniform thinness of an average of one mil. As the slab is split by hand with the aid of this knife the loosened splittings are dropped or placed in a circular tin pan which has a loose or removable bottom. As the splittings accumulate they are pressed down with a tin disk to expel the air and "form a vacuum" whereby the splittings hold together. Each lot of loose splittings pressed in this way forms a disk of its own. As soon as the whole pan is filled with such disks, they are again pressed together, and the pan is then turned over and the bottom pressed out, much as a cake is pressed out of its tin after baking. This ejects all the splittings without injuring the disks. If the splitting are split uniformly thin, gentle pressure will not harm the disk, but if they are not uniformly split, i.e., thin and thick splittings are packed together, they will loosen and fall away from where the uneven thicknesses lie.

The binder should be a pure shellac varnish so made that it will ooze freely on heating and pressing, and on completion of the process only from 2 to 5 per cent. of the varnish will remain in the finished sheet of commutator micanite. This can be tested by dissolving the varnish from a fairly large section of the finished sheet, while a sample of the varnish can be called for to check the purity of the shellac in it. The following quantitative test by Parry for detecting the presence of added resin, as an adulterant to cheapen the varnish, may be useful:—Dissolve the sample of shellac in a little alcohol, and pour the solution into excess of water. The shellac is then precipitated in a very finely divided condition. This is collected and dried on filter paper. It is then triturated in a mortar with a little petroleum ether for five or ten minutes, and the petroleum ether is filtered off. The resin, if present, is dissolved by the petroleum ether, and if this be shaken with a one per cent. watery solution of copper acetate, it will assume an emerald green colour, due to the formation of a compound of the resin with the copper, which is soluble in petroleum ether.

The building-up of the micanite sheet is done as follows:—

A layer of mica splittings is placed on a paper sheet of the desired size, which in its turn is placed on a tray. The splittings are placed in a manner to overlap and care is taken to leave no openings between them. Shellac varnish is sprinkled over them, forming a layer of varnish. Another layer of mica splittings is placed on top of the varnish, care being taken that each layer breaks joint with those below and above it. More layers of varnish and splittings are added until a thickness, a good percentage above the required thickness, is obtained. This allowance is made for contraction in the press. It is next pressed in a steam-heated press, which is heated to a temperature of 120 deg. C. A pressure of 1,000 lb. per sq. in. is applied in the process. After a short time the steam is turned off and cold water is let into the platens and allowed to circulate until the sheet is quite cold. The pressure is then taken off and the finished sheet removed.

If the splittings, the varnish, and the process are as described the sheet will have uniform density throughout, and will not have—a common failure of commutator micanite on the market to-day—high spots, which have received unusual pressure and been thereby weakened, or low spots or pockets filled with varnish. Its specific weight will be fairly uniform, averaging .093 pound per cubic inch. It can be tested according to the best specification tests. For high and low spots and uniformity of thickness, not always visible to the eye, it is usually gauged by means of a mechanical gauge, at various widely distributed points. For percentage of varnish density, and compressibility, it is tested as follows:— When compressed under 2,500 lb. per sq. in. at a temperature of 250 deg. C. it should not shrink in thickness more than from 3 to 5 per cent. The mica splittings should not show more than a slight slipping, nor should there be more than a slight trace of varnish oozing under this test. At a temperature of 150 deg. C., and a pressure of 2,000 lb. per sq. in. there should be no slipping of the splittings, nor any oozing of the varnish whatever. The pressure test is made on enough pieces of 3 in. x 1½ in. to make a block ¾ in. thick, by placing the block in the centre of the testing clamp and tightening up cold with a 12-in. wrench. The clamp should then be placed in an oven and heated for two hours either at 250 deg. C. or 150 deg C., according to the test desired, when the clamp is removed from the oven to be tightened again while hot.

Dielectric Strength.—By preference this test is made by using a brass plate 12 in. square for the lower electrode and a copper or brass block 2¼ in. x 2¼ in. x ¾ in. thick for the upper electrode. When between such electrodes the plate should have an average breakdown voltage of 800 to 900 volts per .001 in. of thickness, and should withstand from 500 to 550 volts per .001 in. of thickness for one minute. When pointed electrodes are used, the average instantaneous breakdown voltage should be from 900 to 1,000 volts per .001 in. of thickness.

From the foregoing it will be seen that the plates

should be perfectly flat, with a smooth surface both top and bottom, and should be of uniform thickness without the necessity of milling.

At present the market standard sizes of sheets are governed by the size of press or width of milling machine, and are usually 36 in. x 18 in.; 23 in. x 40 in.; 20 in. x 20 in.; and 40 in. x 40 in., with an allowable variation of ½ in. in each dimension.

A tolerance is also allowed in the thickness of the sheets, often .0005 in., but it is more usually .001 in. from specified thicknesses. In individual sheets the allowance is .001 in. above or .0015 in. below the thickness specified.

It is not too much to say that mica and micanite better selected and more carefully used will give results that may help to revolutionise the electrical industry.

Mica Table.—The following table is given to show how the mica on the market should be differentiated according to the classes and varieties now mixed and sold under uncertain designations by the trade. The arrangement is well worth very careful consideration by the electrical industry, as each class has different electric strengths, thermal, and physical properties.

Muscovite Micas.

(1) Ruby, clear, hard, flat, tightly laminated.
(2) Ruby, slightly stained hard, flat, tightly laminated.
(3) Ruby, fair stained, hard, flat, tightly laminated.

(Fair stained here means hazy stains due to evaporation of interlaminar water while still *in situ*.)

(4) Ruby, stained, hard, flat, tightly laminated.
(5) Ruby, heavy stained, uncertain, very mixed.
(6) Green, brown, rum, &c., clear, hard, flat, tightly laminated.
(7) Green, brown, rum, &c., S.S., hard, flat, tightly laminated.
(8) Green, brown, rum, &c., stained/spotted, hard, flat, tightly laminated.
(9) Ruby, clear, fairly hard to soft, flat to uneven, loose laminated.
(10) Ruby, S.S., fairly hard to soft, flat to uneven, loose laminated.
(11) Ruby, F.S., fairly hard to soft, flat to uneven, loose laminated.

(F.S. here means hazy stains due to interlaminar defects, organic inclusions, air-bubbles, rock-puncture, evaporating of interlaminar water at surface, &c., uncertain.)

(12) Ruby, stained, soft due to interlaminar water or other defects, flat to uneven, rock-puncture, and veins that often prove to be cracks internally.
(13) Ruby, spotted, hard, flat, tightly laminated.
(14) Ruby, spotted and blotched, uncertain, loosely laminated.
(15) Calcutta white, soft, mixed, usually loosely laminated.
(16) So-called Madras (green and brown), clear, some hard, some soft, flat to uneven, uncertain, loosely laminated.
(17) Green and brown, stained/spotted, uncertain, loosely laminated.
(18) Green and brown, matted, uncertain, loosely laminated.

Phlogopite Mica.

(19) Amber brown, flat, soft, mixed loosely and tightly laminated.
(20) Amber silver brown, flat, soft, mixed loosely and tightly laminated.
(21) Amber blacky brown, flat, soft, mixed loosely and tightly laminated.
(22) So-called amber biotite, uncertain, unsafe to use for insulation.

Transmission Problems.

The Hexaphase System.

By Major A. M. TAYLOR, M.I.E.E., M.Am.I.E.E.

(*Abstract of lecture delivered before the* SOUTH-MIDLAND CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS *at Birmingham.*)

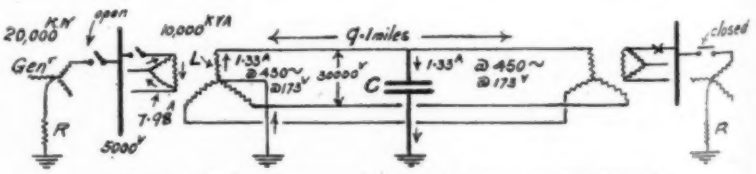
(*Concluded from p.* 433).

Resonance with Delta-star and with Star-star.

The author has sought to tackle the problem of resonance in what he considers a more simple way than that of the somewhat highly mathematical article of Messrs. Evans and Sels, and the basis on which he has worked is to assume that the transformer system, at (for example) the step-down end of the line, gets into what is known as "current resonance" with the capacity system over the whole line; the step-up transformer at the sending end of the line being ignored for this purpose. If a capacitance and an inductance at the end of the line are in "current" resonance at the fundamental periodicity of the supply there tends, speaking generally, to be no current supplied from the generating station to feed this resonating system. The conditions of "current" resonance are: that the magnetising current which excites the transformer requires to be equal, at a given voltage and frequency, to the charging current which enters the condenser. This is the basis on which the author has worked, and he has found simply what oscillation frequency of the line would bring these two currents into equality, treating the line as a "lumped" condensance; *i.e.*, without introducing any correcting factor to turn the distributed capacitance into a "lumped" capacitance.

Consider the case represented by fig. 1, in which a line of 9.1 miles length (4.55 miles if two cables are in parallel), operating at 30,000 volts and transmitting 10,000 kVA at a normal frequency of 25 periods, gives "current" resonance on the 18th harmonic. The right-hand generating station alone is in operation.

The delta secondary at the receiving end acts as a short-circuit to all harmonics of the multiple of three, which means that the currents required on the high-pressure side—now acting as a primary—have to be enormously greater, for a given excitation of the core, than would otherwise be the case. This has the effect of greatly increasing the frequency of oscillation which gives rise to resonance, and is therefore all to the good. The author has shown in the diagram the current in the one limb only of the star winding, but it will be understood that a similar current flows outwardly and simultaneously from the neutral point of all three limbs. (He has also neglected the effect of "distributed" capacitance). To correct for "lumping" the capacitance, the value of the total capacitance of the line may be multiplied



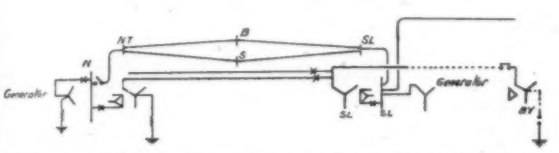
9·1 miles with 1 cable.....gives current resonance on 18th harmonic.
4·55 " " 2 " (in parl.) " " " " 18th "
36·4 " " 1 " ..... " " " " 9th "
18·2 " " 2 " (in parl.) " " " " 9th "
0·2 sq. in., 3-core, 30,000-V cable.

Fig. 1.

by 0.606. He has taken such a current, both for the charging of the condenser and for the magnetising of the transformer (*viz.*, 1.33 amperes), as would give an eighteenth harmonic having a crest value of 1 per cent. of the root mean square value of the fundamental. It is not impossible to conceive of an electro-motive force of this amplitude being actually generated in the primary of the receiving transformer, due to (for example) the latter being worked at somewhat above the normal voltage, which is not unlikely to take place even with the voltage at the generator at the *normal* value on a really long line, under what is known as the "Ferranti effect."

It will be noted that, in order to get resonance on the ninth harmonic, the line would have to be 18 miles long if there were two cables in parallel, and 36 miles long if there was only a single cable. If the "leakage" reactance had been fixed at 10 per cent. (as has recently been proposed in some quarters), instead of at 5 per cent., the lengths of line given would be halved. The 18 miles thus becomes nine miles.

It will be understood that since, with delta-star transformers, the 3rd, 9th, 15th, &c., harmonics are not transmitted through the transformer, the references to these harmonics in the table of Evans and Sels as those at which resonance occurs, must be understood as indicating the *order* of frequency and not the actual frequency. The oscillation, for instance, tabulated as a 9th harmonic would be either a 7th or 11th. A revised value of the sending-end inductance would be necessary if the 3rd, 9th, or 15th harmonics were to be actually considered. Then, again, the question whether the secondary of the step-down transformer is open-circuited,



N=Nechells (Prince's) station; N_T = Nechells temporary station; S_L = Summer Lane; B_y =Bournville; B=Bordesley; S=Saltley.

Fig. 3.

or not (if a star-star transformer), very greatly affects the inductance value to be taken and, whether star-star or delta-star, affects the inductance values to be taken for the 5th, 7th, 11th, 13th, &c., harmonics.

Figs. 2 to 7 are reproduced with the permission of Mr. R. A. Chattock, and represent oscillograms which were taken with the object of ascertaining whether there were any triple, or other, harmonics present in the Birmingham system of sufficient magnitude to cause resonance in the 30,000-volt mains. Fortunately, it was found that—though third harmonics having an amplitude of the order of 20/50 volts existed between the neutral point of the high-pressure star winding of the step-up transformer and earth (when the earthing resistance was removed)—they were insufficient to cause resonance of the third harmonic on the system. The oscillogram showing these third harmonics is reproduced in fig. 3. The connections of the circuit were as shown in fig. 4, with the exception, as just stated, that the earth resistance circuit of 87 ohms was *open* (for the purpose of taking the reading).

Fig. 2 shows the voltage between the neutral point and one of the 30,000-volt cable cores when the earth connection at Bournville was open, but when the Summer Lane and Bournville step-down transformers were both alive. It will be noticed that—particularly in the upper part of the diagram—ninth harmonic ripples are very apparent, and their amplitude might be quite of the order of 1,000 or 2,000 volts.

It has already been shown (fig. 6) that there exist triple-frequency oscillations (superposed upon a small fundamental), but there is no trace of ninth harmonics, and certainly not of this very much greater intensity. In this particular case, however, the switch "3" at Summer Lane (see fig. 3) was closed, and there was in consequence the capacitance of a large 5,000-volt system in inductive connection with the 30,000-volt system. The inductance on the system had not greatly altered (there being hardly any load), but the capacitance had altered quite materially, and one would expect, under these circumstances, that the resonance frequency would be lowered, and that the 9th harmonics would disappear.

Fig. 2.

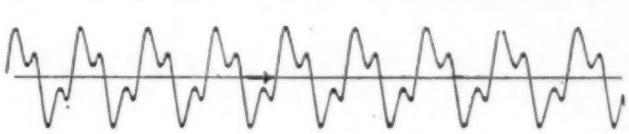


Fig. 6.

Referring to fig. 4, again showing the voltage between the neutral point of the star and one 30,000-volt cable core, and with the same transformers in circuit, and, generally, the same circuit conditions as indicated in fig. 2, it will be noticed that the ninth harmonics are very much more defined and that, in the bottom part of the scale, there is an amplitude of the order of 3,000/4,000 volts (due to a coincidence of 9ths and 11ths). This difference from the conditions represented by fig. 2 is solely due to the (intentional) raising of the excitation of the transformers by increasing the voltage slightly and, though interesting, does not help us as to the cause of the ninth harmonics.

Referring to fig. 7, the conditions only differ from those shown in fig. 2 in that a direct earth connection from the neutral point of the transformers at Bournville was established, the idea being that by this means the triple, or ninth, frequency currents would find themselves partially short-circuited, and thus the impressed harmonic voltage on the condenser would be reduced. It will be noticed that this oscillogram (fig. 7) is very much better than any of the previous ones, and there is reason to believe that, if the 87 ohms had been taken out of the Nechells end, the shape of the wave would have been still better. Fig. 5 is a reproduction of the oscillogram of the voltage between the neutral point and one of the cable cores, but under the conditions of fig. 6, except that the connection with earth (through the 87 ohms) is now re-established; no trace of harmonics is now visible.

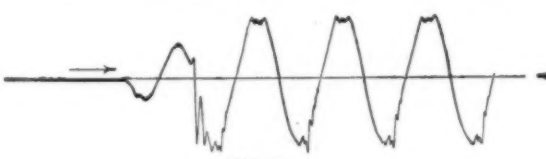


Fig. 4.

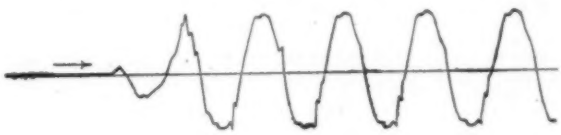


Fig. 7.

The point now arises whether it was possible for ninth harmonics, of the amplitude indicated, to have been set up in the star winding of the Nechells transformer itself, and the author inclines to the opinion that the ninth harmonics are *not* really a case of resonance between the Nechells main transformer and the 30,000-volt cable system, *but are due to resonance between the potential transformers* which were employed in conjunction with the oscillograph—for measuring the oscillations in the cable—*and the capacitance of the high-pressure line*. Fig. 8 shows how the transformers were connected in such a way that a complete oscillation circuit was formed through the four transformers, each wound for 5,000 volts, the earthing resistance, and the capacitance of the cable system.

The moral of this particular experiment is that when using an oscillograph supplied by potential transformers off a high

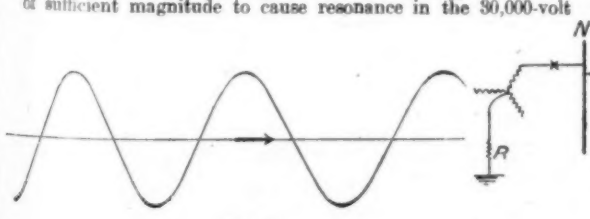


Fig. 5.

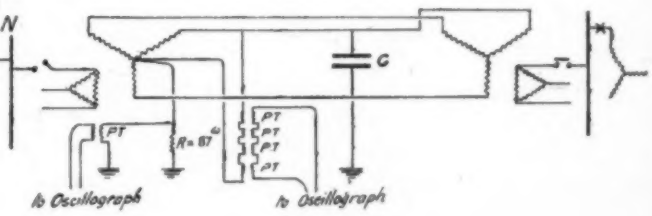


Fig. 8.

source of e.m.f., a careful watch must be kept to avoid resonance, otherwise results may be obtained which are misleading.

Avoidance of Resonance.

When a new transmission line is being projected and it is found by careful consideration of the conditions that there is a tendency to resonance under working conditions that may be serious on the 3rd, 6th, 9th, 12th, 15th, or 18th harmonics, it is advisable to consider:—

First, whether a diminution in the number of kilowatts to be transmitted through each trunk line (if there are two or three in parallel) may be contemplated. This has the effect of lowering the total inductance of the step-up and step-down transformers, while appreciably increasing the capacitance of the cable system.

Secondly, whether the amount of resistance in the earth circuit may not be increased. This will, of course, involve a closer setting of the relays, but this may not be impracticable. In determining the effect of the resistance in circuit, it is desirable to work out the transient for the maximum current at the commencement of the oscillation and find out the relation that this bears to the magnetising current of the transformer and the charging current of the cable at the particular frequency explored for resonance.

Thirdly, if neither of the above corrections may be applied, it is possible that the addition of a tertiary winding to the transformers will so alter the circuit constants that resonance may be avoided.

Fourthly, to what extent the load on the system will modify the tendency to resonance, as worked out for the conditions of no load.

Fifthly, the position of the earthing resistance may materially alter the resonance conditions (*i.e.*, whether it is placed at the sending or the receiving end of the line).

Sixthly, as a last resource, whether it would be advisable to run an insulated neutral cable joining together directly the two neutrals of the step-up and step-down transformers, with the object of completely short-circuiting any triple-harmonic, or multiples of triple-harmonic, voltages. [If the Home Office could be prevailed upon to allow a direct earth connection to be made at the star points at *both* ends of the super-pressure line, the earth currents being brought back through the lead sheathings of the cables, as well as through the earth, there is no doubt that all the 3rd, 9th, 18th, &c., harmonic ripples would be entirely wiped out, being virtually short-circuited on themselves: and consequently all of the initial harmonic e.m.f.'s which *produced* the oscillations would also be neutralised, and there would consequently be no voltage left to produce any appreciable current in the "ground" return.] The author has experimentally proved this to be possible.

If, on the other hand, it is found that resonance tends to obtain on the 5th, 7th, 11th, 13th, &c., harmonics the following considerations will weigh:—In the case of the 3rd, 6th, 9th, 12th, 18th, &c., harmonics, we were considering a circuit having three parallel capacitances in series with three parallel inductances ($L=\frac{1}{3}$; $C=3$) and the whole in series with a resistance (R) to ground. In the case, however, of the 5th, 7th, 11th, 13th, &c., harmonics, we have a circuit containing one capacitance in series with two capacitances in parallel, and these again in series with one inductance and two inductances in parallel in series with the latter ($L=1\frac{1}{2}$; $C=0.75$ roughly), but in this case there is no damping resistance (R). The conditions of the initial oscillation of a transient are therefore totally different from what they are in the case of the 3rd, 9th, 18th, &c., harmonics.

However, in the case of the 5th, 7th, 11th, 13th, &c., harmonics, the ripples can be transmitted through from the generator; hence, the tooth ripples (which are the 11th or 13th in a 25-period, 2-pole generator) can be transmitted through to the capacitances. But, in this case, the generator itself becomes part of the oscillating circuit, as well as all the motor and lighting system connected to the l.p. busbars. This will possibly so reduce the period of oscillation as to prevent resonance so long as there is a fair (inductive) load on the system.

Conclusion.

It would therefore appear that, in laying out a new system, a matter to be considered is whether the local load—if one exists at the generating station end of the line—had better be supplied directly from the generators or stepped down from the super-pressure busbars by transformers. The author has not gone into this point carefully, but at first sight it would seem as though the distribution of circuit conditions could be considerably altered by this means in such a way as to avoid resonance.

Even, however, if the generator should possess slight tooth ripples at a particular load, it would appear that this is not likely to be so serious as "multi-third-harmonic" resonance on the super-pressure line set up by the main transformers themselves, and therefore the latter is the point to be first investigated. It is probable that, in nearly all cases of 30,000-volt transmission, there are 0·25 per cent. third harmonics generated in the secondaries of the transformers; even with a pure sine wave received from the generator.

The author would, in closing, warn engineers against the possibility of current resonance *on the fundamental* on 30,000-V lines of 10 miles and over.

The Transmission Maintenance of Telephone Systems.

By F. E. ERIKSON, M.I.E.E., and R. A. MACK, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

Transmission maintenance is a vital phase of telephonic communication. In its broadest sense it is interpreted to mean not only the upkeep of telephone lines and apparatus from a purely physical standpoint, but also the provision of methods and apparatus to guard against the introduction of factors which are detrimental to the satisfactory transmission of speech.

The paper is divided into two parts, the first of which deals with the broad aspect of the subject, the economic justification of good maintenance, and the general lines upon which it should be carried out. What transmission losses may mean from an economical standpoint is shown by a recent statement of Captain J. G. Hines*: . . . "in the case of an exchange of moderate size, such as that at Willesden, which is about 7½ miles from the trunk exchange, a reduction of one mile s.c.e. in the local line allowance can only be made up on the existing trunk junctions by an additional capital expenditure of approximately £6,600. As there are 100 exchanges of various sizes in the London area, the total expenditure that would be involved by a general reduction of the loss by one mile is very large." The capital expenditure referred to above could not fully compensate for losses occurring between subscribers' stations and the end of the trunk junctions. The above example is, therefore, more indicative of the money value of losses occurring in plant used only during trunk connections.

TABLE I.

Description of circuit.	Average loss.	Limiting loss.	Abnormal loss.	Cause of abnormal loss.
	Miles of standard cable.			
Standard "A" operator's cord circuit	1·4	2·0	5·4	Non-inductive relay winding disconnected.
Incoming junction circuit	0·7	1·4	11·5	4-μF condenser disconnected.
Telephone operator's set	3·5	4·8	5·0	350-ohm resistance short-circuited.
Subscriber's set*	4·0	4·5	8·9 8·7	17-ohm winding reversed. 26-ohm winding reversed.
Private branch exchange cord circuit	1·2	1·5	4·1	Non-inductive relay winding disconnected.
Private branch exchange telephone circuit	1·2	1·5	7·3	Induction coil windings interchanged.

* Transmitting loss, all others measured as bridge losses in the circuit.

Under normal operating conditions the transmission loss in any one circuit is bound to vary, but having obtained sufficient test data it has been possible to establish an average and also maximum (limiting) values (see Table I), the latter indicating the point beyond which abnormal losses may be suspected.

Considerable attention has recently been given to the sub-

* Paper read before the Institution of Post Office Electrical Engineers on November 13th, 1923.

scribers' part of the local line plant, and it is believed that development work now in progress will result in simple and inexpensive means being provided for checking the efficiencies of subscribers' transmitters and receivers after the latter have been put into service.

The upkeep of junction and subscribers' lines for the purpose of ensuring good transmission differs only in degree from that required for the long lines. In a country-wide system such as that represented by the long lines in the United States or Great Britain, it is more desirable to limit

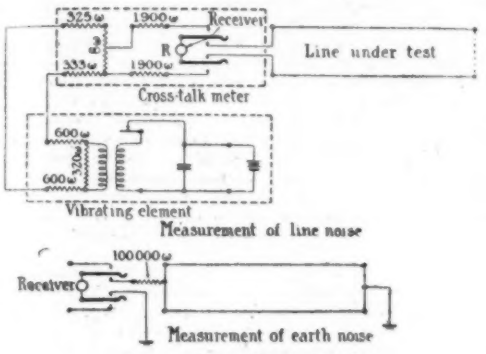


Fig. 1.—Noise Measuring Set.

the use of loading coils on open-wire lines and to obtain the desired grade of transmission by means of repeaters alone. We may therefore regard the long-distance system as

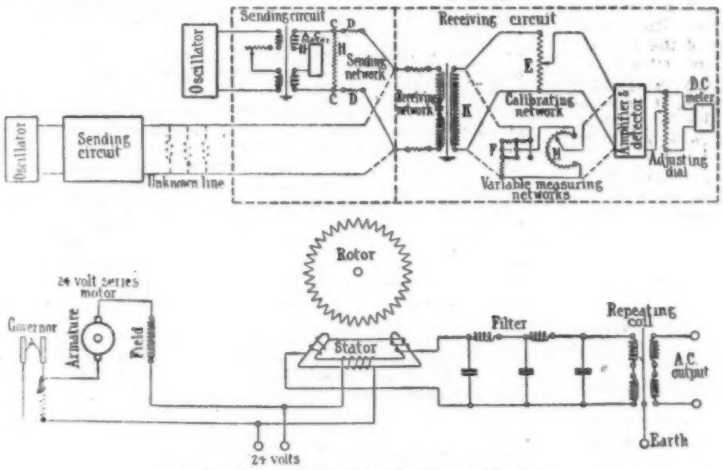


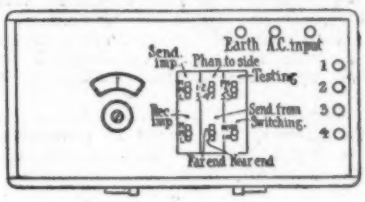
Fig. 2.—"3-A" Transmission Measuring Set.

sections of high-grade lines, located between repeater stations, or connecting the latter with terminal cities. It would not be practicable to depend solely on the maintenance of the individual sections (*i.e.*, between repeater stations) for the successful operation of the system as a whole. The control of the circuit as a working unit, and the responsibility for securing a specified transmission-equivalent, must rest with one station selected for that purpose.

In his I.E.E. inaugural address Mr. F. Gill gave a striking example of the condition which will arise if the gains obtainable by means of repeaters are not maintained at their specified values. The authors describe briefly the nature of tests for this purpose and the practical methods used in applying them to the system as a whole.

Experience has culminated in the development of precision measuring sets in such forms that they can be operated reliably by the more skilled members of the regular maintenance staff. By the use of such instruments the very considerable economy resulting from good transmission maintenance can be realised, and a number of such instruments are described in the paper.

The noise upon any circuit can be directly measured by means of a "1-A noise measuring set" (fig. 1) in terms of an arbitrary noise unit, so that an estimate can be made of the reduction in intelligibility in any given case due to the presence of a given amount of noise. It is a portable instrument including a standardised vibrating element of comparatively low fundamental tone very rich in harmonics. It is used in conjunction with a potentiometer, the noise upon the circuit under test being observed in a receiver and measured by adjusting the potentiometer setting until the noise in the receiver, when connected alternately to line and



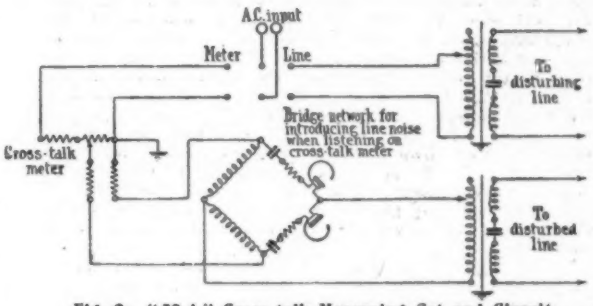


Fig. 3.—"50-A" Cross-talk Measuring Set and Circuit.

standard, is judged to cause the same interference with conversation. When measuring noise to earth, the two wires of a circuit within the cable under test (being subjected to the inducing influence) are connected to earth through a high-resistance in series with the noise-measuring receiver and the noise units present in the receiver measured by comparison with the noise standard. This quantity can be regarded as a measure of the voltage to earth induced by the disturbing influences and tending to cause noise upon the circuit due to unbalances. The number of noise units present in the receiver when connected across the two lines of the circuit is then measured. This quantity can be regarded as a measure of the noise induced in the circuit. The ratio between the noise of the metallic circuit and noise to earth so measured may be taken as a rough index of the balance to earth of the cable under test from the viewpoint of freedom from inductive interference.

Two further instruments used in connection with noise investigations are the 2-A noise analysing set, which enables the relative magnitude and importance of various frequencies present in a noise to be estimated, and the meter used to measure the telephone interference factor of the wave-form of any electrical machine or system, this factor being an approximate measure of the relative tendency which the electrical plant involved will have to cause noise in a telephone circuit, other conditions remaining constant.

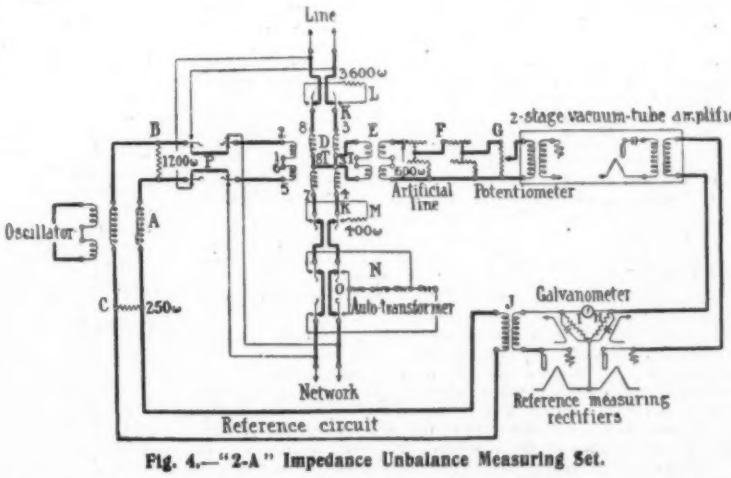


Fig. 4.—"2-A" Impedance Unbalance Measuring Set.

In making cross-talk measurements upon noisy lines, difficulty is experienced in obtaining a good balance between the cross-talk current in the testing receiver when connected alternately to the disturbed line under test and to the cross-talk meter. This practical difficulty is eliminated in the

cross-talk measuring set indicated in fig. 3 in which two balanced receiving circuits are used to connect together the receivers, the "listen" terminals of the cross-talk meter and the disturbed line in such a manner that the line noise will be heard at all times in the receivers while the presence of the disturbed line will not affect the current flowing into the receivers from the cross-talk meter, and *vice-versa*—an application of the Wheatstone bridge principle.

An instrument for measuring in a rapid routine manner such parts of the exchange equipment as experience has shown to be subject to defects is the 1-B transmission measuring set which will also measure the loss in junction, trunk lines, &c., provided that the two ends of the circuit or equipment to be tested can be made available at the testing point. The set can be used for measuring attenuation only when both ends of the line or circuit under test are available at the set, which involves the looping back of lines at a distant point. Apart from the inconveniences of such a method, the disturbance to traffic conditions involved by the use of several lines simultaneously for testing purposes has justified the development of an instrument which, when in use, involves only the line under test. This instrument, fig. 2, is portable, employs a direct-reading meter, visual instead of audible indication, and is also arranged to permit the current supply conditions of subscribers' operator's cord circuits and switching trunks to be measured.

A still higher development is the 4-A set for use at the more important centres in the trunk line plant for making measurements over a greater range of conditions, particularly as regards frequency, than is possible with the sets already described. It is intended as a permanent fixture in important terminal stations, and is provided with a number of local circuits terminating in jacks for the use of the test clerk, to facilitate the measuring of a large number of circuits with a minimum of delay. Various signals and a telephone set are provided for use in conducting the tests. The circuit arrangements are similar in principle to those of the 3-A set.

So that the gain given by any repeater (of either the 2-wire or 4-wire type) in a repeater station may be checked and calibrated for any setting of the gain control, it is usual to provide at least one repeater gain set of the No. 2 type, situated on the same racks as the repeaters in close proximity to jacks connecting to the various repeaters. One of the panels comprises the gain unit and the other an amplifier unit.

A repeater gain measuring set in a portable form is the 3-A, which can be used also for the measurement of transmission losses.

The gain at which 2-wire repeaters can be satisfactorily operated depends to a large extent upon the degree of balance existing at all essential frequencies between the impedance of the line and the balancing network associated with it. It is sometimes necessary to know the "singing point" at a number of frequencies in order that the nature of the cause of the unbalance may be located. This information can be quickly obtained by means of the 2-A impedance unbalance measuring set, fig. 4.

The heavy lines show the conductors used when making unbalance measurements. The set works on a null system in which a current depending upon the quantity being measured is balanced through a galvanometer against another current from the same source which flows in a reference circuit. This set can also be used for the location of line impedance irregularities, although this operation can be more directly and simply determined by the use of the line impedance bridge.

The 4-B vacuum-tube oscillator used in conjunction with several of the measuring and testing sets described is designed to furnish alternating current of pure wave-form over a range of from 100 to 5,000 cycles per second by steps of 20 cycles per second with an accuracy of 0.1 per cent. It comprises an oscillating tube, two amplifying tubes, and an adjustable resonant control circuit, and the power supply required is 1.0 ampere at 24 volts, and 0.5 ampere at 130 volts. A rheostat and meter are provided for adjusting the filament current. The oscillator is reasonably portable, being mounted in a box with carrying handles.

The time is not distant when these tools will be regarded by the maintenance forces of telephone administrations as indispensable as the Wheatstone bridge is to-day and they will form part of their regular equipment in the future. Successful transmission maintenance depends more upon the dissemination of sufficient knowledge throughout the rank and file of the operating staff, than upon expert knowledge possessed by officials at headquarters.

The authors acknowledge their indebtedness to the American Telephone and Telegraph Co. and the Western Electric Co. for much of the data contained in this paper; which was illustrated with lantern slides showing the instruments described, many of which were also exhibited for inspection after the meeting. An appendix to the paper deals with a new unit for transmission measurement recently introduced in the Bell system in America. It may be defined as follows:—"The transmission unit is one such that two powers are said to differ by one transmission unit if they are in the ratio of $10^{0.1}$ to 1." The new unit does not vary with frequency, is logarithmic in character, based on a power ratio, and is of convenient size.

Discussion in London.

Mr. S. A. Pollock opened the discussion by characterising the paper as a description of Western Electric instruments devised for use on American telephone systems. The need for simple and convenient apparatus such as was referred to had always been felt, but the paper seemed to advocate centralised supervision and maintenance. Was centralised maintenance economical? When loss of efficiency was found by means of instruments, there remained the location of the fault and its remedy. Although sectional testing for faults might not be possible over the whole system in the country, where fault-locating tests were made testing for efficiency might be superfluous. The aim of the British Post Office was to devise routine tests for underground cables which would detect and locate faults before they affected the efficiency or revenue-earning capacity of the circuit. The G.P.O. Research Department had encountered similar problems to those referred to and had adopted similar methods of overcoming them. There was no difficulty in providing the instruments; it was an economic question of how much money could be spent. What would be the cost of applying the authors' methods to the whole country? In Appendix 2 a radical change was proposed and he hoped it would receive attention as the apparent simplicity of the new unit for transmission measurements made it attractive.

Mr. A. J. Stubbs thought the subject of capital importance and, as an instance of the value of increased care and expenditure in maintenance, recalled that a good many years ago the then engineer-in-chief authorised the maintenance allowance on certain cables serving the Continent to be doubled. The result was that not only were those circuits available for a much longer proportion of their time, but the actual speed of transmission increased about 40 per cent. He was not enamoured of the term "frequency spectrum."

Mr. F. Gill pointed out that much apparatus had been introduced into telephone circuits with the object of improving transmission, but what if it did not work? The economic value of the paper was that it described a line of instruments for fault detection which could be used by ordinary skilled men; they should be used where it paid to do so, but not as a matter of form. Quoting from a communication from Mr. T. G. Miller, long lines superintendent of the American Telephone and Telegraph Co., whose system contained 1,100,000 miles of wire representing some 27,000 miles of pole lines, he said the use of repeaters and such like apparatus had made the need for better transmission measurement imperative, and without the instruments described in the paper it would be difficult, if not impossible, to maintain a satisfactory service on many of the circuits in use; 85 per cent. of the long lines belonging to that company, including all the complicated circuits, were measured regularly at transmission measuring desks. Another use for such instruments was the checking of exchange equipment during construction. In the U.S.A. centralised control meant that decisions as to policy, &c., were come to by one man, but there were others all along the line each doing his particular share towards maintenance. He was convinced that eventually they would have to adopt some form of unity control in Europe.

Mr. A. J. Aldridge said that the noise loss of 15 miles of standard cable referred to in the paper as occurring on some American lines seemed to be excessive and would not be tolerated in this country. The authors' instruments were not peculiar to the U.S.A., and he thought they had not chosen the best method of producing a standard noise; the G.P.O. was producing a better one.

Capt. B. S. Cohen expressed the view that if the authors' methods were satisfactory for trunk lines, they would be even more useful for terminal circuits because the transmission losses in terminal apparatus were becoming formidable. Three types of testing machines had been developed in this country and the value of such apparatus lay in the fact that it located defects which could not be detected otherwise with the plant *in situ*. The noise loss mentioned in the paper seemed to be extraordinary.

Mr. G. D. Edwards, an American telephone engineer who had recently returned from work connected with the installation of a 330-mile trunk telephone line between Stockholm and Gothenburg, said that it would not have been possible to complete that work without the aid of the instruments described in the paper. The Swedish Telephone Administration quickly recognised the importance of central control and had introduced it with gratifying results.

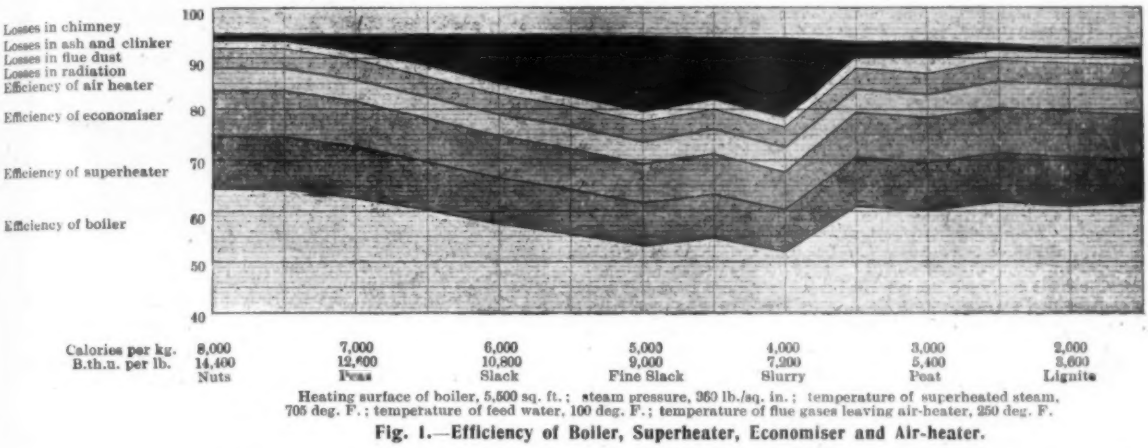
Mr. E. S. Ritter pointed out that there had been developed in this country methods of testing for insulation to a very high degree of precision. On a 300-mile underground cable a 300-megohm fault could be localised to within plus or minus a mile, and a dry or badly soldered joint could also be localised approximately. The apparatus described in the paper was made necessary by the use of repeaters and the trouble seemed to be that the lines were not good enough for the repeaters.

In view of the lateness of the hour the authors postponed their reply for publication in the I.E.E. *Journal*.

American Electric Vehicle Exports.—During December last only 17 electric vehicles, valued at $14,901, were exported from the United States, as compared with 49 and $62,678 respectively in the last month of 1922.

The Pluto Stoker.

A PATENT stoker, new to this country, but well known on the Continent, has been introduced here by the Pluto Stoker Company. As shown in the accompanying figure, the grate is made in two parts, one inclined and the other horizontal; both sections are formed of long narrow bars, each about 6 in. wide, which have an alternate to and fro motion; the horizontal bars engage with the inclined bars, which are driven by a rocking driving shaft by levers and connecting rods. This motion is very slow, the bars going forward and backward only once or twice a minute.



Heating surface of boiler, 5,500 sq. ft.; steam pressure, 360 lb./sq. in.; temperature of superheated steam, 705 deg. F.; temperature of feed water, 100 deg. F.; temperature of flue gases leaving air-heater, 250 deg. F.

Fig. 1.—Efficiency of Boiler, Superheater, Economiser and Air-heater.

The inclined bars are hollow, and consist of troughs with easily renewable surfaces consisting of standard firebars. The horizontal bars are open at the bottom, and their surface is formed by similar standard firebars. The fire is in contact with the standard firebars only, the long bars thus being kept cool and having no wear and tear.

The length of the inclined part varies from about 6 ft. to 14 ft.; the horizontal bars are 3 to 7 ft. long, so that the stokers can be made in all sizes between 11 ft. and 12 ft. long.

The width of the stoker depends on the width of the boiler. For boilers over 9 ft. wide between walls, two stokers may be applied; it is also possible, by using the Pluto suspended arch (patent applied for), to build the stokers up to any width required.

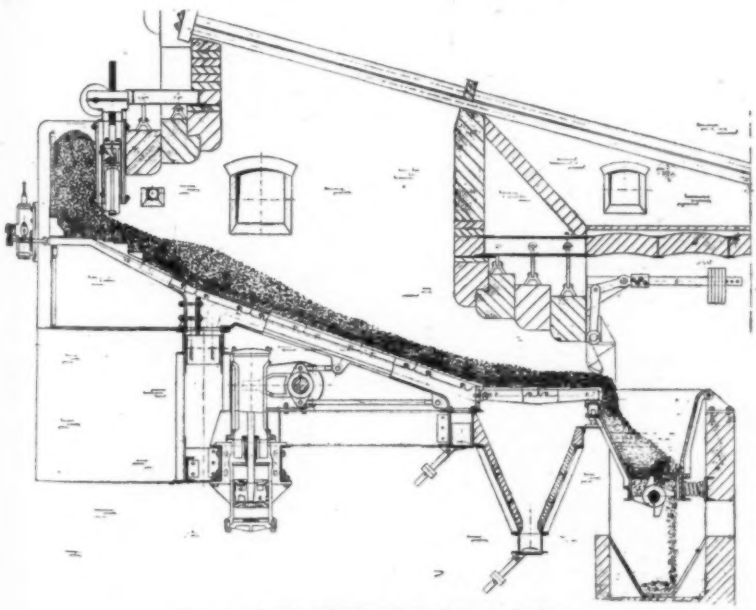


Fig. 2.—Sectional Elevation of Pluto Stoker.

The front portion of the stoker consists of a large hopper, a ram, and a furnace door. The ram over the whole width of the stoker is fixed to the even numbers of the grate bars, going forward when these go forward and pushing the fuel on the inclined part of the grate. From these the fuel travels over the grate by the motion of the bars and by gravitation. On the horizontal portion the fuel accumulates, and the whole surface of the grate is well covered. At the same time, the ashes and clinker have ample time to be completely burnt before dropping over into the ashpit at the end of the grate.

Air for combustion enters the fuel bed through the hollow bars. The pressure of the forced draught varies at the different parts of the grate, being high at the top, and lower towards the back end of the grate. The last part can be worked with natural draught.

The driving shaft is actuated by a steel arm connected to an hydraulic motor; the speed and travel of the stoker can be regulated easily by regulating the water supply and stroke of the hydraulic motor. The stoker can also be driven by an electric motor with a reduction gearbox or from existing shafting.

The Pluto stoker is generally erected directly under the boiler, so that a good radiation is obtained on the lower water-tubes, the space occupied in front of the boiler being 3 or 4 ft. The front arch is usually short; the length of the arch at the rear end depends on the quality of the fuel.

Without arches it would be impossible to burn very wet fuel, such as lignite, tanning refuse, bagasse, slurry, &c., but by the use of ignition arches these fuels are quickly dried when fed into the furnace, and the ignition gives no trouble.

On the other hand, accumulation of heat is wanted at the rear end of the stoker to burn the coke which is still left in the ashes and clinker, for which purpose a high temperature is needed. Hence the Pluto stoker has an arch fixed over the horizontal grate.

The use of preheated air is advantageous, especially when using low-grade fuel. The higher the temperature of the preheated air in the ignition zone and in the ash zone the better, but it is not advisable to work the combustion zone with highly preheated air. The air admission on the Pluto stoker is therefore arranged in such a way that hot air can be supplied through the first and last parts of the stoker, whereas cold air is supplied to the combustion zone (a patent for this arrangement has been applied for).

It is claimed that with this stoker the easy regulation of the forced draught and the drop in pressure towards the end of the grate make it possible to obtain a very high percentage of CO_2 without unburnt gases. The unburnt fuel in the ashes and clinker is reduced to a minimum by the use of the horizontal gratebars. The poking movement helps in this regard, as it continually breaks up the surface of the fire and ensures a thorough mixing. At the Amsterdam power station, where Scotch Duff having about 9,000 B.th.u. lower heating value is burnt, the percentage of unburnt fuel in the ashes is only 3 to 5 per cent. It is also stated that the Pluto stoker can burn a great variety of fuels. Tests made in Holland and Belgium have shown that fuels with as much as 50 per cent. or 60 per cent. moisture or from 30 to 35 per cent. ash with 20 per cent. moisture (slurry) can be burnt successfully. Fig. 1 shows the efficiencies obtainable with various kinds of fuel. The consumption of power is low, only 1/100 to 1/200 h.p. per sq. ft. of grate area. The power expended on the forced draught is also low, as the percentage of excess air is a minimum. To produce a further reduction in the power consumption, the forced

draught can be obtained with three fans, each giving the exact amount of air and at the exact pressure wanted at the different parts of the grate. Although the capital cost of this arrangement is slightly higher than the cost of one fan, the advantage is that not the whole quantity of air has to be compressed to the high pressure and then again reduced to the pressure required. As the output of the driving motor has to be proportional to the second power of the pressure, it will be readily understood that the saving obtained in this way is considerable. This arrangement at the same time allows of the use of preheated air on the part where it really is wanted, that is, the ignition zone and the ash grate bars, whereas cold air is used on the rest of the stoker.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

New Relay with Self-contained Ammeter.

A line of overload and directional relays equipped with a current-indicating element is a product of recent work by the Westinghouse Electric and Manufacturing Co., East Pittsburg, Pa., U.S.A., in the field of protective devices for electrical circuits. These relays have self-contained ammeters which give a continuous indication of the current flowing in the circuit to which the relay is connected. They are designed for use where the relays are mounted on the front of a switchboard and where there is insufficient room to provide separate ammeters. In addition to operating as protective relays, these devices indicate the current flowing through the relay circuit, which not only shows the current in the feeder, but also proves to the operator that the relay is receiving current through its circuit, and is therefore in condition to operate if a short circuit should occur.

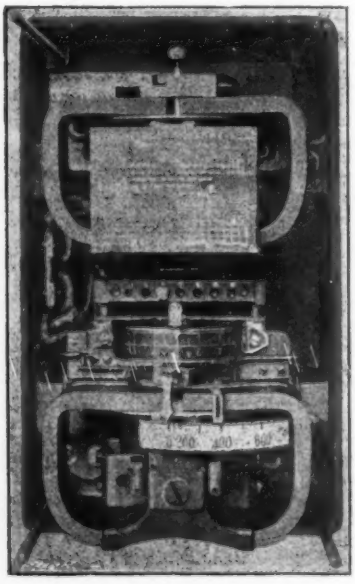


Fig. 1.—Relay with Self-contained Ammeter.

The indicating element of this new relay (fig. 1) consists of a thin copper disk mounted on a separate shaft and having its own jewel bearing and control spring. It is actuated, however, by the same flux as operates the main disk to close the contacts of the relay. This prevents the indicating element from operating when there is any trouble either inside or outside the relay that would prevent the main electromagnet from being energised.

A Novel Advertising Device.

One of the most effective advertising devices shown at the recent Business Efficiency Exhibition, at the Central Hall, Westminster, was the "Fortuna" machine, illustrated in fig. 2. This consists of a heavily-plated drum mounted on an enamelled base. Inside the drum are four powerful electromagnets which are rotated by a small electric motor in the top of the drum. The magnets are capable of sustaining metal articles weighing anything up to 3 lb., keeping them in a state of activity. One application, which can be seen in the illustration, consists of a metal cylinder to which is attached an arm holding a card. Another effective device is the group of steel balls which are held together and carried round by the influence of the magnets. Messrs. Tollit and Harvey, Ltd., 40, Gresham Street, E.C.2, are suppliers of the machine.

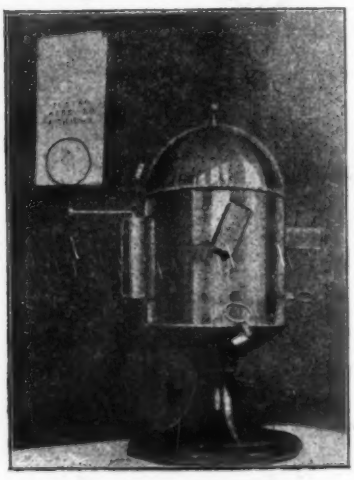


Fig. 2.—The "Fortuna" Advertising Device.

The "Armstrong" Table Stove.

The accompanying illustration (fig. 3) shows a new pattern of table cooker (the "Armstrong") now being sold by the Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, N.17. By means of this device boiling, toasting,

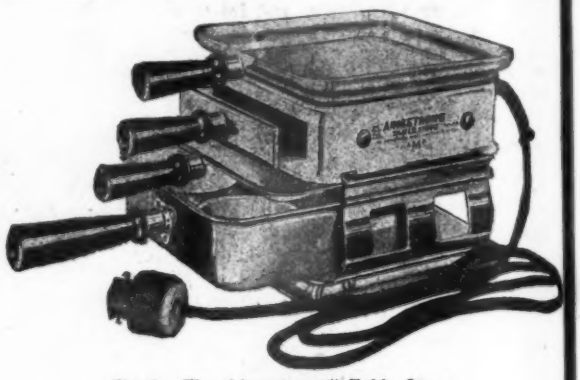


Fig. 3.—The "Armstrong" Table Stove.

frying, steaming, &c., can be conveniently accomplished. The stove is made of nickel-plated pressed steel, and the cooking utensils of aluminium. The heating chamber is finished in white enamel. The loading is about 600 W, and the appliance measures 7 in. in length and width, and is 6½ high.

The "Lithotex" Timing Clock.

Messrs. Pictorial Machinery, Ltd., 7, Farringdon Road, E.C., makers of the well-known "Lithotex" machines used universally in the printing of textiles, bank-notes, stamps, &c., have produced, to work in conjunction with their plant, an electric timing clock (fig. 4). This clock has been specially designed to eliminate the uncertain personal element in the making of photographic exposures, the accuracy of which plays such an important part in modern photo printing processes. The dial having been set to the necessary time interval from one second to any period required, the push button is then operated. The clock then sets in operation, in this case, a camera shutter, which remains open for the time required, and, when the interval has elapsed, the shutter automatically closes and the apparatus re-sets itself to repeat the consecutive operations when started. The number of the exposure is registered, and a warning buzzer sounds during the time interval.

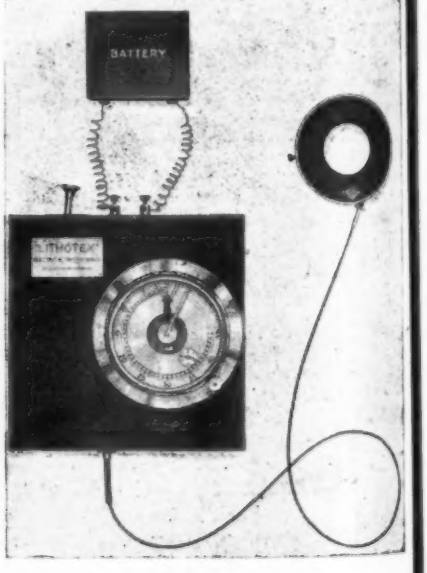


Fig. 4.—The "Lithotex" Timing Clock.

The clock is operated by a small dry battery, and no doubt could be utilised to advantage in manufacturing processes where consecutive time operations now performed by skilled attendants could be more simply and accurately controlled by means of the time clock in the hands of unskilled labour.

A Cable-Stripping Machine.

MR. J. HALL, 23, Sticker Lane, Laistergate, Bradford, has sent us particulars of a machine for stripping armoured cables which he has designed. The machine consists of two frame sides through which run two cutter shafts and four feeder shafts. The latter are driven by the cutter shafts through worm gearing to obtain the necessary speed reduction. On the ends of the shafts are halved V rollers, which may be adjusted to take cables of from 1 in. to 4 in. diameter. The two front rollers have a slitting saw running between them, the rollers themselves are loose and the cutter fast. The two rear rollers are grooved so as to grip the cable, and they are fitted with a key-way to enable them to slide. Before the cable enters the rollers it is gripped by jaws to take the strain; these are released when the cutters have started on the cable. The two top shafts are made to lift, as shown in fig. 5, should it be necessary to extract the cable. Underneath the front bearings are two adjusting screws to set the cutters to a given size of core. The sole makers are the St. Helena Engineering Co., Wibsey, Bradford.

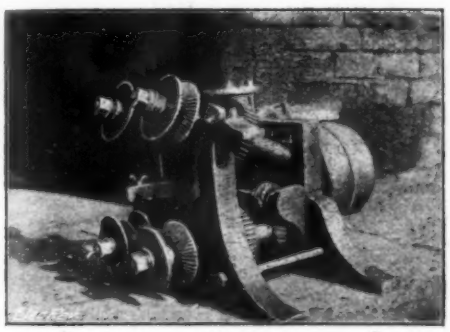


Fig. 5.—Cable-stripping Machine.

Saws for Wire-Armoured Cables.

In addition to their saw for cutting through the steel-tape armouring of cables, MESSRS. FRY'S (LONDON), LTD., 46, Upper Thames Street, E.C.4, have now produced a saw for use with wire-armoured cable.

The "Tudor" Fire.

The "Tudor," an inexpensive electric fire of sound construction, is among the new designs recently produced by ELECTRICAL UTILITIES, LTD., Tudor Works, Park Royal, N.W.10.

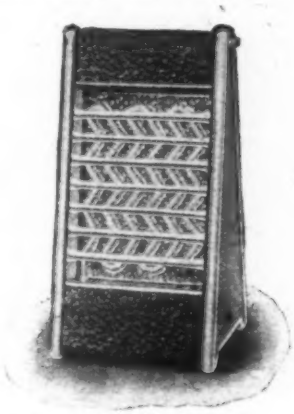


Fig. 6.—The "Tudor" Fire.

This fire, which is illustrated in fig. 6, is provided with a special type of non-sagging element of 750 or 1,000 W. It is supplied in two finishes, *viz.*, with a copper surround, hammered and polished, and with copper-plated side castings, or with an aluminium surround, hammered and polished, and nickel-plated side castings.

Exports and Imports of Electrical Goods and Machinery in February, 1924.

THE February returns of electrical export and import business show a falling off in all three divisions, exports, imports, and re-exports, but allowance must be made for the fact that it was a month of only 29 days.

The totals of electrical exports for the month were £2,474 less than in January, and electrical machinery values fell off to the extent of £44,651; decreases were also recorded in the sections for batteries and accumulators (£15,403), and meters and instruments (£17,634). On the other hand, the exports of telegraph and telegraph cable and material and insulated wires and cables were higher by £68,097 and £16,300 respectively. It is satisfactory to note that the total values of electrical exports for the month were £316,934 in excess of those for February, 1923.

Electrical imports for February dropped £6,847 as compared with January, decreases occurring in the sections for glow lamps, meters and instruments, electrical machinery, and telegraph and telephone instruments and apparatus; whilst the figures for insulated wires and cables, enumerated electrical goods and apparatus, batteries and accumulators, showed enhanced values. As compared with February, 1923, the electrical import figures for the month under review were higher by £43,880.

Re-exports of colonial and foreign electrical goods and machinery were £15,601 lower in value than in January and £798 above those for February, 1923, the largest falling off (£12,601) occurring in the telegraph and telephone instrument and apparatus section.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Feb., 1924.	Inc. or dec. as compared with Jan., 1924.	Inc. or dec. as compared with Feb., 1923.	Electrical imports for Feb., 1924.	Inc. or dec. as compared with Jan., 1924.	Inc. or dec. as compared with Feb., 1923.	Electrical re-exports for Feb., 1924.	Inc. or dec. as compared with Jan., 1924.	Inc. or dec. as compared with Feb., 1923
Electrical goods and apparatus (unenumerated)	£136,757	— £7,000	+ £51,565	£77,628	+ £5,371	+ £23,790	£4,582	— £1,135	+ £1,442
Insulated wires and cables ...	232,043	+ 16,300	+ 46,309	32,993	+ 7,845	+ 12,042	75	— 90	— 23
Glow lamps	22,424	— 4,895	— 3,782	6,828	— 5,787	— 18,977	437	— 3,751	— 195
Arc lamps and parts	805	— 724	+ 505	1,291	+ 346	+ 309	57	— 91	+ 57
Batteries and accumulators ...	38,671	— 15,403	— 8,497	28,144	+ 6,215	+ 18,834	576	+ 306	+ 241
Meters and instruments ...	29,053	— 17,634	— 2,306	11,158	— 5,728	+ 507	2,058	+ 1,695	+ 1,678
Carbons	4,701	+ 2,936	+ 1,212	13,963	+ 3,973	+ 9,392	21	— 15	— 515
Electrical Machinery—									
Electrical machinery (unenumerated)	194,416	+ 18,567	+ 70,264	57,451	— 13,223	— 26,635	6,620	— 739	— 3,945
Railway and tramway motors	30,532	— 9,317	+ 2,362	—	—	—	—	—	—
Other motors and generators ...	184,337	— 52,766	+ 52,369	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	12,252	— 1,035	+ 4,714	53	+ 48	+ 53	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	90,975	+ 24,454	+ 23,975	4,628	+ 418	— 1,863	280	+ 280	+ 280
Submarine telegraph and telephone cable	54,421	+ 18,048	+ 27,147	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	221,789	+ 25,995	+ 50,857	55,297	— 6,320	+ 26,428	2,928	— 12,061	+ 1,808
Totals	£1,253,176	— £2,474	+ £316,694	£289,434	— £6,847	+ £43,880	£17,624	— £15,601	+ £798

The Electrical and Engineering Exhibits at Wembley.

Preliminary Notices.

(*Continued from p.* 410.)

MESSRS. BRUCE PEEBLES & CO., LTD. (Edinburgh), will show a 500-kW automatic Peebles-la Cour motor converter in operation, d.c. and a.c. motors, windings, &c.

THE BRITISH ELECTRIC TRANSFORMER CO., LTD., is to show a 20,000/3,820-V, 1,875-kVA single-phase transformer; a 2,000-kVA three-phase transformer; and transformer kiosks. There will be a "Tricity" section devoted to the display of heating and cooking appliances.

THE D.P. BATTERY CO., LTD. (Bakewell), is supplying "Kathanode" batteries for a fleet of "Railodok" passenger cars which will tour the grounds.

THE TELEPHONE MANUFACTURING CO., LTD., in addition to automatic telephone equipment, "Laryngaphones," &c., will display "Soutterware" lighting and heating fittings, and radio apparatus.

MESSRS. E. BROOK, LTD., (Huddersfield), intend to exhibit squirrel-cage and slip-ring motors, an alternator, and a model demonstrating electric motor drives in workshops.

THE MICANITE & INSULATORS CO., LTD., will show insulating materials and manufactures—mica, micanite, "Paxolin," "Leatheroid," &c.

MESSRS. STUART TURNER, LTD. (Henley), propose to exhibit small lighting sets and models of steam and internal-combustion engines.

MESSRS. BROWETT, LINDLEY & CO., LTD. (Manchester), will show a gas engine and a steam engine typifying their manufactures, and a steam-driven air compressor.

MESSRS. JAMES HOWDEN & CO., LTD. (Glasgow), will have on view a model Howden-Ljungström air pre-heater, turbine and reciprocating-engine generating sets, a compound tandem engine, valves, boiler mountings, &c.

MESSRS. COLE, MARCHENT & MORLEY, LTD. (Bradford), will have a display consisting of a 400-h.p. uniflow steam engine; "C.M. & M-Delas" steam-jet air extractors, and model air filters and coolers, in addition to the surface condensing plant which they have installed in the power house.

THE EASTERN TELEGRAPH CO., LTD., will show examples of apparatus used with submarine cables, including a keyboard perforator, Wheatstone transmitter, electrolytic magnifier, "jockey" relay, &c. In addition there will be a mirror galvanometer, an original model of a siphon recorder, and other telegraphic accessories.

THE LEA RECORDER CO., LTD. (Manchester), proposes to exhibit boiler feed water measuring apparatus, coal meters, &c., and it has also supplied condensate-measuring and recording apparatus and coal meters for the power station.

MESSRS. BABCOCK & WILCOX, LTD., will have on their stand models of their boilers, oil-fuel burners, soot blowers, feed-water regulators and recorders, portal cranes, and other power-station equipment, much of which is being installed in the Exhibition power house.

MESSRS. RUSTON & HORNSBY, LTD. (Lincoln), will display internal-combustion engines, an electrically-operated drag-line excavator, and a 250-kW generating plant.

BRITISH ELECTRIC VEHICLES, LTD. (Southport), will show two typical industrial trucks, and a small electric locomotive.

MESSRS. BEST & LLOYD, LTD. (Birmingham), will have a small stand displaying electric lighting fittings.

ELECTRIC CONTROL, LTD., is to exhibit "Empire" automatic controllers for a.c. and d.c. motors, and a complete range of indoor and outdoor e.h.p. switching and protective equipment.

MESSRS. JOHN DUGDILL & CO., LTD. (Hazel Grove, Stockport), are arranging a collection of movable-joint fittings, brackets, pendants, &c., portable lamps, and spot lights.

MESSRS. GALLOWAYS, LTD. (Manchester), will show a 500-i.h.p. uniflow engine in motion, multiple-flow superheaters, boiler fittings, welding electrodes, &c.

MESSRS. EDGAR ALLEN & CO., LTD. (Sheffield), intend to show representative examples of their mining and crushing machinery, steel trackwork, small tools, and steel products.

OZONAIR, LTD., is to show apparatus for air purification for a variety of applications.

MESSRS. ALLEN, EVERITT & SONS, LTD. (Birmingham), will have a display of condenser tubes, plates, and ferrules, and other products of brass, copper, nickel, &c.

MESSRS. THOS. BROADBENT & SONS, LTD. (Huddersfield), intend to exhibit hydro-extractors for textile goods, and other centrifugal machines and centrifugal clutches.

THE BRITISH MANNESMANN TUBE CO., LTD., is to show steam pipes, hydraulic power lines, weldless cylinders, and other steel-tube work.

MESSRS. HOLMAN BROS., LTD. (Camborne), will include in their exhibit a 15-20-h.p. electric hoist, air compressors, pneumatic tools, &c.

MESSRS. TWEEDALES & SMALLEY (1920), LTD. (Castleton), will display textile machinery of many types.

MESSRS. J. BROCKHOUSE & CO., LTD. (West Bromwich), are to show laminated springs, axles, coach fittings, and iron castings and stampings.

MESSRS. W. & T. AVERY, LTD. (Birmingham), will exhibit an electric weighing machine, as well as other weighing machines and hardness testing machines.

MESSRS. ROBEY & CO., LTD. (Lincoln), have arranged to display a uniflow engine, a gear-driven electric winding engine, and a number of oil engines.

THE PITTER GAUGE & PRECISION TOOL CO., LTD. (Woolwich), will show measuring machines and gauges of various patterns.

THE CALEDONIAN WIRE ROPE CO., LTD. (Airdrie), is to display ropes for mining, engineering, and other purposes.

MESSRS. ATTWATER & SONS' exhibit will consist of bakelite, mica, micanite, ebonite, and other insulating materials.

THE MOND NICKEL CO., LTD., will show nickel, copper sulphate, gold, silver, and platinum in various states.

MESSRS. ROBERT HALL & SONS (BURY), LTD., are displaying looms, winding machines, and other textile machinery.

SHEEPBRIDGE STOKES CENTRIFUGAL CASTINGS CO., LTD., will exhibit castings in grey cast iron and non-ferrous metals.

SERCK RADIATORS, LTD. (Birmingham), will show oil and water coolers, preheaters, and radiators.

MESSRS. DEWRANCE & CO.'s display will comprise boiler mountings, high-pressure valves, steam traps, gauges, and bearing metals.

THE PULSOMETER ENGINEERING CO., LTD., will include in its exhibit centrifugal, turbine, and ring pumps, exhausters, valves, and a rate-of-flow indicator.

MESSRS. GUEST & CHRIMES, LTD. (Rotherham), are to exhibit turbine water-meters, fire hydrants, sluice valves, mine rescue apparatus, &c.

MESSRS. THOS. FIRTH & SONS, LTD. (Sheffield), intend to show their stainless steel in various forms, as well as steel forgings and castings, files, saws, &c.

THE KITSON ENGINEERING CO. (LONDON), LTD., will have an exhibit comprising refrigerating plant, rotary pumps, and incandescent paraffin vapour lamps.

PALMERS SHIPBUILDING & IRON CO., LTD. (Hebburn-on-Tyne), is to exhibit models of vessels, a 200-ft. radio mast, oil storage tanks, oil separators, &c.

MESSRS. HADFIELDS, LTD. (Sheffield), intend to show specimens of steel castings and forgings, stone and ore crushing machinery, special trackwork, &c.

THE BENJAMIN ELECTRIC, LTD., will have a representation of an illuminating engineering department with engineers at work preparing lighting schemes. Industrial lighting fittings will also be shown.

MESSRS. JOHNSON & PHILLIPS, LTD., will show sections of cables, including 33,000-V and telephone cables, the "J. & P." wiring system, switchgear, transformers, and outdoor equipment.

PRINCES ELECTRICAL SURE TIME CLOCKS, LTD., will exhibit its master-clock controlled time-keeping system.

THE DOWSING RADIANT HEAT CO., LTD., proposes to exhibit radiators, irons, branders, glue pots, and other electrical appliances.

THE PARK ROYAL ENGINEERING WORKS, LTD. (in liquidation), is supplying the main d.c. switchboard for the power house.

THE BRITISH IGNITION APPARATUS ASSOCIATION, LTD., will have a joint exhibit comprising magnetos, &c., made by six firms.

THE LIVERPOOL ELECTRIC CABLE CO., LTD., is to display rubber-insulated wires and cables.

MESSRS. EVERETT, EDGCUMBE & CO., LTD., intend to exhibit a large selection of measuring instruments, relays, photometers, &c.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., and its associated companies, are showing ships' radio equipment, broadcasting apparatus, &c.

SWITCHGEAR & COWANS, LTD., is to have a display of switchboards of the "flat" and truck types, instrument and lighting transformers, switches, &c.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., will have an "Exide" service station in the grounds, as well as numerous battery exhibits on its stand.

BRITISH INSULATED & HELSBY CABLES, LTD., will have a collection of wires and cables of many types, in addition to cable accessories, condensers, electric welders, meters, &c.

THE ANGLO-SWEDISH ELECTRIC WELDING CO., LTD., will show tested welds made by the "Kjellberg" system, and a model of a welded boiler.

MESSRS. J. J. ARMFIELD & CO., LTD., will exhibit water turbines, including one directly coupled to a generator, oil pressure governors, &c.

MESSRS. RANSOMES & RAPIER, LTD., will include in their exhibit a 2-ton petrol-electric crane, an electrical jack, solenoid brakes, a model electric capstan, &c.

MESSRS. ALFRED GRAHAM & CO.'s display will comprise naval loud-speaking telephones, torpedo and fire-control gear, electric motor horns, dimming switches, and radio loud speakers.

Messrs. Nalder Bros. & Thompson, Ltd., propose to show measuring instruments of all kinds, relays, circuit breakers, instrument transformers, &c.

Messrs. Crossley Bros., Ltd. (Manchester), are arranging a selection of their gas and oil engines.

The National Gas Engine Co., Ltd. (Ashton-under-Lyne), will exhibit a 150-b.h.p. vertical gas engine in operation, as well as lighting sets and other gas and oil engines.

Messrs. Drummond Bros., Ltd. (Guildford), are to show force pumps, concrete mixers, logging saws, &c.

Messrs. Sterns, Ltd., are supplying lubricants for the whole of the machinery in the Palace of Engineering.

Messrs. George Angus & Co., Ltd. (Newcastle-on-Tyne), propose to show "Maag" silent gears, belting, brake linings, &c.

Messrs. Taylor Bros. & Co., Ltd., are to have an exhibit of rolled-steel disk wheels, rolled-steel tires, &c.

The Monk Bridge Iron & Steel Co., Ltd. (Leeds), is showing samples of iron and steel, axles, forgings, &c.

Brown Bayley's Steel Works, Ltd. (Sheffield). Steel products, including tires, axles, springs, &c.

The Lamplough Daylamp, Ltd., and the Chromoscope Co. will have a joint exhibit consisting of "daylight" lamps and colour-changing and transposing instruments.

The Rawlplug Co., Ltd., is to display various applications of "Rawlplugs," aluminium fittings, recess screws, &c.

Messrs. Beck & Co., Ltd., will show examples of their water meters, valves, drilling and tapping apparatus, &c.

The New Pelapone Engine Co., Ltd. (Dewsbury), is exhibiting paraffin-engine driven lighting sets, complete with switchboards.

Messrs. Ronald Trist & Co., Ltd., will exhibit a "Glover-West" boiler fitted with feed-water regulator, water-level indicator, &c.

Messrs. James Stott & Co.'s exhibit is to consist of gas governors, water boilers, and canteen equipment.

Electrical Installations, Ltd., will show photographs of work executed by them.

Messrs. Lacy-Hulbert & Co., Ltd. (Croydon), are arranging a display of pumps, air compressors, electric tire inflators, and similar machinery.

The Astor Engineering Co. (1913), Ltd., proposes to exhibit marine engines, generating sets, feed-water regulators, donkey pumps, &c.

The Cargo Fleet Iron Co., Ltd. (Middlesbrough), and its associated companies, are exhibiting structural steel-work of various kinds, including 25-ft. diameter tunnel rings as used on the City and South London Railway, a new steel furnace, and steel products of many types.

The Wallsend Slipway & Engineering Co., Ltd., proposes to show a complete oil-burning installation for a marine boiler, oil-burning furnaces, &c.

Messrs. S. Instone & Co., Ltd., and their associated companies will have an exhibit consisting of samples of coal and by-products, as well as model aeroplanes.

Messrs. Wallis & Steevens, Ltd. (Basingstoke), are showing a new type of steam-roller.

Ever-Ready Co. (Great Britain), Ltd., will show dry cells for various purposes, portable lamps, &c.

Messrs. L. McMichael, Ltd., are arranging a selection of radio apparatus—complete sets, components, and accessories.

The Relay Automatic Telephone Co., Ltd., has erected a 200-line automatic exchange for the use of exhibitors, and it will also show other exchanges in operation.

Messrs. Ferguson, Pailin, Ltd. (Manchester), are to display armour-clad compound-filled switchgear, industrial and outdoor types, cubicle patterns, &c.

The Tudor Accumulator Co., Ltd., is to show a very large battery (15,984 Ah capacity at 10-hour rate), as well as numerous smaller batteries.

Messrs. Elliott Bros. (London), Ltd., will have a collection of indicating and recording instruments, small transformers, marine apparatus, testing sets, &c.

The Foster Instrument Co.'s stand will bear pyrometer installations, distance thermometers, mechanical testing apparatus, and automatic furnace controls.

British Arca Regulators, Ltd., will show its controlling relays in various applications.

The India Rubber, Gutta Percha and Telegraph Works Co., Ltd., will show cables and wires, telegraph instruments, and rubber, ebonite, gutta-percha, and other materials in various forms.

The Macintosh Cable Co., Ltd., is to exhibit v.i.r., bitumen, and paper-insulated cables, its surface wiring system, joint boxes, &c.

The Radio Communication Co., Ltd., will have examples of ships' radio sets, a direction-finding set, an automatic call device, and other radio apparatus.

Messrs. Crompton & Co., Ltd. (Chelmsford), propose to show a 300-kW, 6-phase rotary converter, a 3-phase auto-synchronous motor on load, a motor-generator set, and printing-press equipment.

Messrs. Erskine, Heap & Co., Ltd. (Manchester), will exhibit cubicle and other switchgear and motor starters of many patterns.

Messrs. Greenwood & Batley, Ltd. (Leeds), are to display mining and industrial type motors, a 2-ton battery truck, and an Entz magnetic transmission unit.

The London Electric Wire Co. and Smiths, Ltd., will have a collection of rubber-insulated wires and cables, including flexible cords, telephone cables, &c.

Messrs. John Cochrane (Barrhead), Ltd., are showing motor-driven pneumatic forging hammers, &c.

Ferodo, Ltd. (Chapel-en-le-Frith), will show samples of brake linings, stair treads, &c.

Messrs. A. G. Mumford, Ltd., are to exhibit steam- and electrically-driven pumps and boiler feed water regulators.

Sir W. G. Armstrong, Whitworth & Co., Ltd., will have an exhibit including machine tools, locomotive work, road-making machinery, pneumatic tools, lighting sets, &c.

Messrs. Merryweather & Sons, Ltd., will show fire-fighting appliances of all kinds, a vertical water-tube boiler, submersible pumps, &c.

Messrs. Howard & Bullough, Ltd. (Accrington), are to exhibit an air-drying sizing machine for textile work.

The Beldam Packing & Rubber Co., Ltd., will show jointing and packing for steam installations, &c.

The Bristol Tramways & Carriage Co., Ltd., is showing a 4-ton chassis.

Messrs. Mirrlees, Watson & Co., Ltd., are to show condensing plant and crushing machinery.

Messrs. Henry Wiggin & Co., Ltd., will exhibit raw materials and manufactured metal sheets, wires, &c., in addition to finished articles showing their application.

Messrs. James Hodgkinson (Salford), Ltd., are showing automatic coking-type stokers and sprinkling stokers in operation, damper fittings, &c.

(To be continued.)

Parliamentary.

[By Our Special Parliamentary Reporter.]

Unemployment and Electrical Development. — Major Lloyd George, during the debate on the estimates for the Ministry of Labour, on March 10th, said he had been disappointed at not hearing from the Minister of Labour some mention of schemes for the improvement of the electrical resources of the country. If we were to succeed in the race for industrial supremacy, we must bring down our costs of production. The only way to do that was by increasing the output; and the most efficient way of doing that was by placing more machinery at the disposal of our workpeople, and by providing motive power for machinery as cheaply as possible. Electricity was by far the most efficient motive power that was known. There was an enormous wastage in the generation of electricity in this country owing to the large number of authorities and the different systems employed; but the greatest waste was in fuel consumption. The amount of coal that was consumed in electricity works to-day was capable of generating three times as much electricity as was produced. There was a large amount of coal which would not stand transportation, but yet could be used for the generation of electricity at the pit head. The putting in hand of electrical schemes would not only give work to the unemployed, but would enable us to start on the race for industrial supremacy that was coming with far greater advantage than we possessed at present.

Mr. Hopkinson said that, as was very often the case with non-technical people, Major Lloyd George evidently thought that it was only necessary to make electrical power stations big enough to be able to sell electrical power to the consumer at a very low rate. But that was a complete fallacy. The difference in cost to the consumer between electrical energy produced at a 500,000-kilowatt station and that produced at a 10,000-kilowatt station was only a fraction of a penny. The real cost to the producer lay in the distribution.

Mr. Gosling, the Minister of Transport, in reply, said that the electrification of the South-Eastern and Chatham section of the suburban lines of the Southern Railway was proceeding, and it was intimated at the recent annual meeting of the company, that it had been decided to carry the electrification of the Brighton section as far as Sutton during the present year and to extend the electrification of the South-Western section as far as Dorking. It was hoped that these schemes would be carried through by the end of next year. With regard to the extension of the tube railways, the extension to Hendon was opened in November last, and he understood that it was expected that the Camden Town junction line would open next month, and the Edgware extension during the summer, and that it was hoped that the Morden and Kennington extension would be completed during the next year. He agreed that every stimulus should be given to the development of electricity in all quarters. The Commissioners had already done a good deal by the organisation of districts, but it must not be supposed that the industry was not developing very rapidly. The period since the appointment of the Commissioners had been one of intense activity in the electricity supply industry, due to the overtaking of arrears of development brought about by war-time restrictions, to the provision made for meeting the trade boom following the war, and to the impetus given by the 1919 Act and the resultant action of the Commissioners in connection with the reorganisation of the supply. From January, 1920, to March 31st,

1923, the Commissioners had sanctioned either for new generating stations or for extensions of existing stations, an increase of 60 per cent. in the three years. The capital invested at the end of the financial year in electricity supply undertakings had grown to the following amounts: 286 local authorities, £92,299,060, and 191 companies, £52,000,000, making a total of £144,299,060, representing an increase on the 1919 figures of 52 per cent. in the case of local authorities and 34 per cent. in the case of companies. The loans sanctioned by the Commissioners from January 31st, 1920, to December 31st, 1923, for the electricity undertakings of local authorities, 1,700 applications in all, amounted to about £44,000,000. Wherever possible the use of water power was being watched. He had had an opportunity of looking into the Severn Valley Scheme, but he was convinced that much more advice of an expert character was necessary before coming to a conclusion. With regard to London, the reorganisation of the electricity supply was badly needed. Last year the Commissioners prepared an Order which it was hoped would be accepted by all parties, but difficulties arose and the Court held that the Commissioners had not the power to do what they had done. They were therefore trying again, and they would publish a new Order very shortly, which, he hoped, in spite of conflicting interests, would be accepted and would enable them to get on with the work.

London Electricity Charges.—On March 10th, Lieutenant-Colonel T. S. B. Williams asked the Minister of Transport, seeing that a new order dealing with the amalgamation of all the electricity undertakings in and around London was to be published by the Ministry of Transport, and that various London supply companies were seeking extensions of time for their Provisional Orders, if he would take steps to ensure that the interests of the consumers were safeguarded in the matter of prices for lighting and power, meter rents, and maximum charges for electric current, and that a sliding scale of dividends based on the price charged for electricity be established in the same way as the sliding scale of gas companies.

Mr. Gosling said that the Electricity Commissioners were about to issue a new Draft Order for reorganising the supply of electricity in London and district. This Draft Order, which must form the subject of a local inquiry, would contain provisions to ensure the regulation of prices and dividends of the London companies in the event of the companies being granted an extension of tenure under the provisions of Section 14 of the Electricity (Supply) Act, 1922.

London Electricity Supply Bills.—The No. 1 and No. 2 Bills have been read a second time in the House of Lords.

Broadcasting Licences.—Mr. Hartshorn, the Postmaster-General, informed Mr. Baker that the total number of broadcast receiving licences on February 29th was approximately 636,000, and of experimental receiving licences 56,000. There was no information as to the relative proportions of the various kinds of apparatus, but crystal sets were believed to preponderate largely. Amateurs were forbidden to transmit on a wave length within the band allocated to broadcasting during broadcasting hours. The question of discontinuing all amateur transmission by spark apparatus was under consideration in conjunction with the other Government departments concerned, but the prohibition of *all* amateur transmission during broadcasting programmes would not be in the public interest.

The Marconi Agreement.—On March 11th, Sir B. Chadwick asked the Postmaster-General whether the Government was aware that in the agreement made between the Marconi Company and the Governments of South Africa and Australia it was provided that the wireless telegraph rates were to be at least one-third lower than the cable rates at present prevailing; and whether, in the event of the Post Office conducting these services in this country, he was prepared to give a similar undertaking.

Mr. Hartshorn said that the answer to the first part of the question was in the affirmative. The Post Office was prepared to co-operate in the contemplated reduction, on the understanding that the net rate per word would be equally divided between the station in this country and the station in South Africa or Australia taking part in the communication.

Glow Lamp Exports.—On March 11th, Mr. S. Webb informed Mr. Lumley that the total value of exports of electric glow lamps of United Kingdom manufacture registered in 1922 as consigned to all foreign countries during the year 1922 was £78,002. Consignments to the Australian Commonwealth in the same year were valued at £123,323. The Australian import duty on foreign filament lamps for lighting and heating was 3s. per lb. weight, the preferential rate of duty being 1s. per lb.

Patent Fees.—On March 11th, Mr. Crooke asked the President of the Board of Trade whether, in view of the fact that, according to the latest statistics issued by the Controller of Patents, the profit made by the Patent Office for the year ending December 31st, 1922, was £74,074, he would consider the advisability of reducing patent fees to encourage inventors.

Mr. Sidney Webb said that the fees paid on the grant of a patent were insufficient to cover the cost involved in the examination of patent applications and the profit made by the Patent Office was derived from the renewal fees which, presumably, were only paid on successful patents. In view of the fact that this profit had decreased of recent years, he was not prepared, as at present advised, to reduce those fees.

County of London Electric Supply Company Bill.—This Bill was read a second time in the House of Lords on March 12th.

Trade Facilities Guarantees.—On March 13th, Mr. W. Graham, Financial Secretary to the Treasurer, informed Mr. Hore-Belisha that the following figures showed the guarantees sanctioned and taken up under the Exports Credits Scheme of the Trade Facilities Act in respect of iron and steel manufactures and certain groups of engineering products. Guarantees sanctioned and not yet taken up are shown in parentheses:—Vehicles (Locomotives, ships, aircraft), £1,200,360 (£506,788); Machinery, £3,438,545 (£97,944); Electrical goods, £83,768 (nil); Iron and steel; manufactures thereof, £989,467 (£1,783,066). The advances made total £93,521.

Published Specifications.

1922.

22,368. "Rotating field magnet for electrical machines with high revolutionary speed." M. Gruber. August 17th, 1922. (Addition to 151,630.) (211,514.)

31,395. "Thermo-electric switches and the method of applying the same to intermittently illuminated electric signs and similar devices." P. V. Castell-Evans and J. M. Longe. November 17th, 1922. (211,550.)

31,455. "Vacuum tubes." E. Y. Robinson. November 17th, 1922. (211,551.)

31,466. "Electric inductance coils and the like." H. P. T. Lefroy. November 17th, 1922. (211,553.)

31,559. "Electric lamp signalling device." W. E. Shuttleworth. November 18th, 1922. (211,555.)

31,847. "Rapid regulation of the voltage of alternating-current generators." P. C. Rushen (Siemens Schuckertwerke). November 21st, 1922. (211,570.)

31,895. "Inert galvanic cells." Seal Co. (London), Ltd., H. D. Pattinson, J. Rose, and I. Jascourt. November 22nd, 1922. (Cognate application 20,868/23.) (211,571.)

31,932. "Electric switches." W. T. Gray, N. E. North, and Metropolitan-Vickers Electrical Co., Ltd. November 22nd, 1922. (211,572.)

32,008. "Method of winding coils used in electrical machines having semi-closed slots." Ateliers de Constructions Electriques de Charleroi. December 6th, 1921. (190,127.)

32,093. "Rheostats." A. K. E. Strathdee. November 23rd, 1922. (211,579.)

32,189. "Spark plugs." H. Fairbrother (Meaker Spark Plug Co.). (November 24th, 1922. (211,584.)

32,207. "Facsimile telegraphic systems." Etablissements E. Belin and E. Belin. November 24th, 1922. (211,585.)

32,218. "Systems of electrical distribution." British Thomson-Houston Co., Ltd., and F. P. Whitaker. November 24th, 1922. (211,586.)

32,370. "Selective switches particularly applicable for use in telephone systems." Western Electric Co., Ltd., and G. Deakin. November 27th, 1922. (211,593.)

32,536. "Method of electrical searching for ore." Svenska Radioaktiebolaget. December 8th, 1921. (190,134.)

32,621. "Dynamo-electric machine." D. Suchostawer. November 29th, 1922. (Cognate application 10,682/23.) (Patent of addition not granted.) (211,598.)

34,299. "Head-attachment gear for telephone receivers and the like." British Thomson-Houston Co., Ltd., A. P. Young, and J. H. Butcher. December 15th, 1922. (211,630.)

34,609. "Automatic means for adjusting lift-cages to correct landing-level." D. Bone, W. J. Huggett, and Express Lift Co., Ltd. December 19th, 1922. (211,635.)

34,637. "Railway signalling systems." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. December 19th, 1922. (Patent of addition not granted.) (211,637.)

34,853. "Telephone systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). December 21st, 1922. (211,639.)

1923.

4. "Cases for electric fuses and other electrical apparatus." H. Heath and R. W. Bill. January 1st, 1923. (211,646.)

1,335. "Telephone systems." Western Electric Co., Ltd. (L. Polinkowsky). January 15th, 1923. (211,662.)

1,397. "Electromagnets." R. Bosch Akt. Ges. January 20th, 1922. (192,069.)

1,805. "Chains for suspending electric lamp pendants, electroliers, and the like." F. Stokes. January 20th, 1923. (211,665.)

4,174. "Automatically-operated electric motor starters and controllers." Brookhirst Switchgear, Ltd., and A. C. Livesey. February 13th, 1923. (211,680.)

4,462. "Portable electric lamps." M. Zeiler. February 15th, 1923. (211,694.)

4,680. "Multi-core cables for high-frequency telephony or telegraphy." B. E. D. Kilburn (Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij). February 17th, 1923. (211,697.)

5,213. "Electric motor control systems." T. Zweigbergk. February 22nd, 1923. (211,705.)

6,089. "Secondary batteries." E. Mallett. March 2nd, 1923. (211,714.)

7,452. "Mountings or attachments for telephone receivers." H. J. Brookes. March 15th, 1923. (211,722.)

7,579. "Electrical terminals." I. H. Parsons. March 16th, 1923. (211,726.)

9,089. "Electrical automatic road signal device for cross-roads and turnings." W. Deacon. April 3rd, 1923. (Addition to 196,719.) (211,738.)

9,784. "Dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd. April 11th, 1922. (196,279.)

11,456. "Telephone systems." Siemens & Halske Akt. Ges. May 15th, 1922. (197,666.)

11,979. "Charging of electric accumulators or storage batteries." J. H. Runbaken and W. Torrance. May 3rd, 1923. (211,761.)

14,379. "Dynamo-electric machines." J. Burke. June 15th, 1922. (199,382.)

15,215. "Electromechanical lamp with winding-up device for domestic use." A. Luzy. July 13th, 1922. (200,800.)

16,036. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). June 20th, 1923. (211,776.)

18,131. "Methods and machines for coating cores." Western Electric Co., Ltd. (Western Electric Co., Inc.). July 13th, 1923. (211,784.)

21,648. "Systems of electric distribution." British Thomson-Houston Co., Ltd. (General Electric Co.). August 27th, 1923. (211,803.)

23,930. "Telephone repeater systems." Western Electric Co., Ltd. September 28th, 1922. (204,708.)

24,750. "Apparatus for effecting repeated closings of automatic electric switches." Akt.-Ges. Brown, Boveri et Cie. October 9th, 1922. (Addition to 186,036.) (205,095.)

25,550. "Electric trigger release for operating safety-catches, bolts, and locks." A. Miller. October 13th, 1923. (211,810.)

25,695. "Spark plugs." C. S. Swanson. October 15th, 1923. (211,811.)